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THE NATURE BOOK

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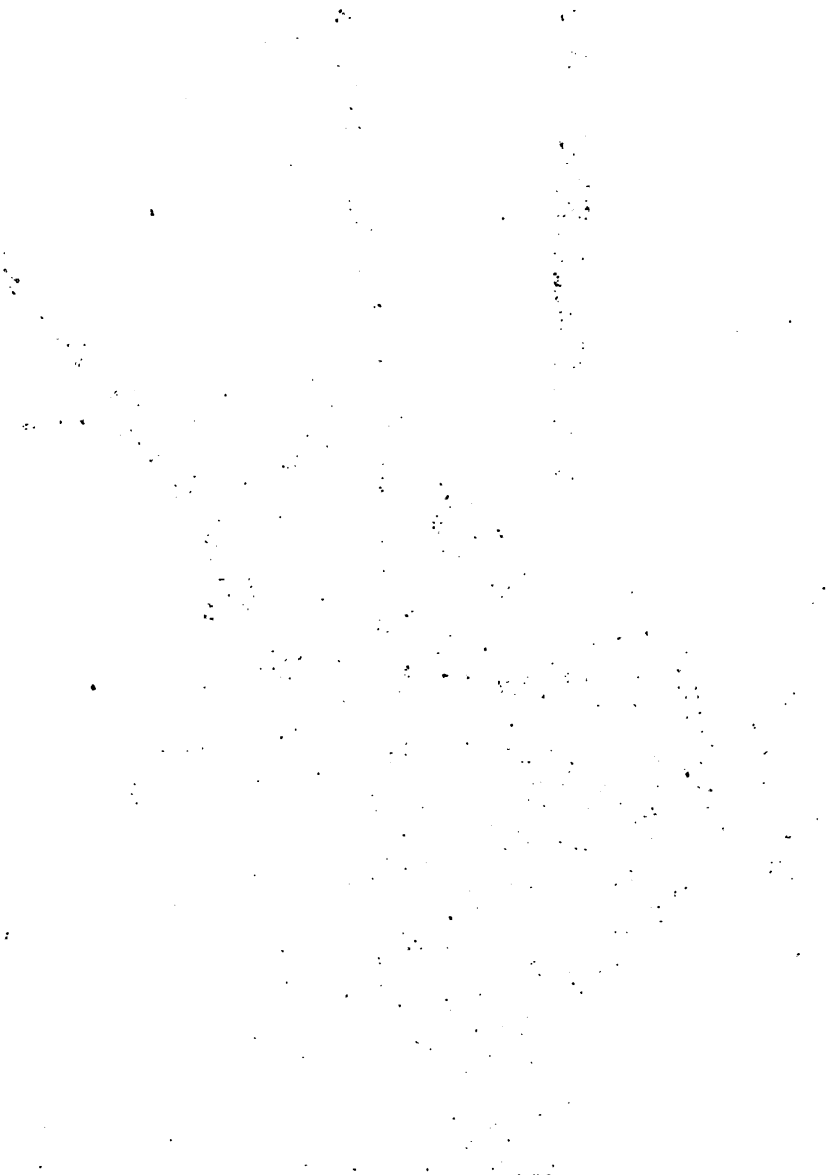
SEDGE-WARBLER FEEDING YOUNG CUCKOO.

Photograph by Cherry Kearton.



THE NATURE BOOK

A POPULAR DESCRIPTION BY PEN AND CAMERA OF THE DELIGHTS AND BEAUTIES OF THE OPEN AIR

*

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1908

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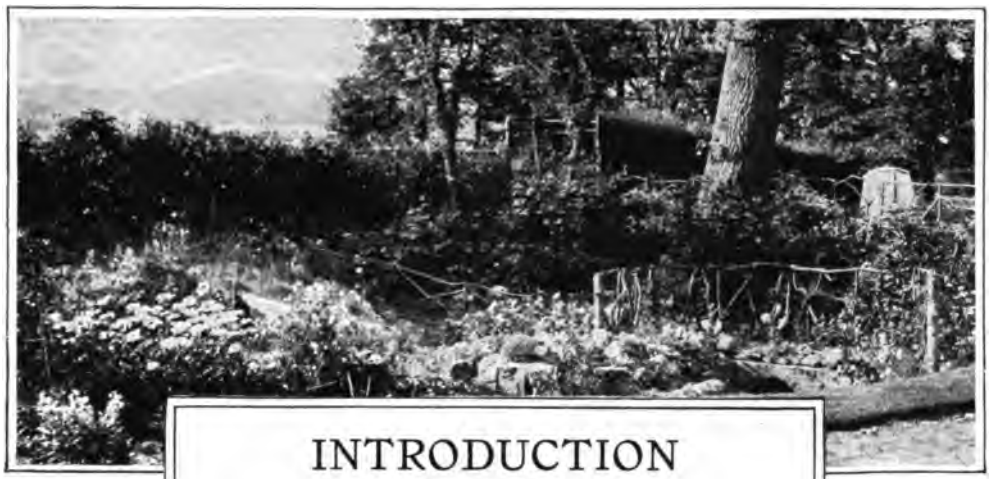


INTRODUCTION

ON THE LOVE OF NATURE

By WALTER CRANE

THE tendency of modern civilised life seems, unhappily, to remove mankind more and more from close touch and sympathy with wild Nature. The town-dweller, for the most part, has to be content with such piecemeal substitutes for the green and open country as he may find in our public parks and gardens, and those rare green oases in the midst of our arid wastes of bricks and mortar, where it is still possible to see grass and flowers and leafy boughs, where the chirp of the dauntless London sparrow mingles with the softer note of the blue rock, which now almost competes with the ubiquitous bird of Venus, as the camp follower of man and the haunter of cities.

It is true there is an abundance of literature which makes constant appeals to the love of Nature, as well as to the desire of more knowledge of country life. Our newspapers frequently have articles to remind us of the changes of the seasons —over and above the daily weather report and forecast—recalling the quiet persistent life of the birds, and the never-ending wonder of their annual migrations. The writers, however, frequently appeal to the sporting instinct, which, perhaps, had at all times much to do with forming the habit of observation of Nature in man. For direct knowledge of the appearance of wild birds and animals in their natural habitat we are now more indebted to the patient photographic artist, with his frequently quite remarkable resources and ingenuity in obtaining his marvellous results.

Nothing, however, can quite compensate for the absence of those early impressions of a childhood passed in the country, when almost unconsciously a knowledge of the familiar trees, wild flowers, birds and animals and their habits, is acquired in the course of a life spent mostly out of doors in the woods and fields. Those who have such early memories seldom, I think, lose their love of Nature, and generally cherish a longing to return to the scenes of their youth. Even the town bred man may be at times conscious of a certain hunger for wild Nature, weary of the monotony of joyless, treeless streets, or touched by the pathetic response of struggling bulbs in glasses or

window boxes, as it were, reaching out for life with their tender green fingers, or when even the forlorn trees in dismal back yards respond to the touch of spring. Often, as the earth turns again towards the sun to renew her youth, some lingering instinct of our primitive arboreal ancestors awakens in us, and we feel with Keats that—

"To one who has been long in city pent,
'Tis very sweet to gaze into the fair
And open face of Heaven, to breathe a prayer
Full in the smile of the blue firmament."

It is pleasant to think that these yearnings are deeply planted in human nature, and that in cherishing them we are really gaining kinship with those interpreters of Nature, the poets and painters and naturalists. There is, however, not a little danger that long banishment from communion with Nature, especially amid the feverish rush and pressure of modern life, in many cases deadens the primitive feelings of sympathy with the natural life of the earth, as well as the powers of perception. The house of the mind accustomed to be filled with noisy guests shrinks from the silence and solitude by which man becomes intimate with Nature. Away from human voices and companionship, in the green quietude of the woods, or roofed but by the open sky on the moorlands, or on the shore by the breaking waves, many are oppressed by a sense of loneliness, although there is no loneliness like the loneliness felt in the midst of crowds of pre-occupied and unknown individuals hurrying to and fro in the streets of London. But, as Wordsworth says :—

"The world is too much with us, late and soon,
Getting and spending we lay waste our powers."

We do not give ourselves time to yield to the influences of Nature. Our ears have been deafened by the noise of city life, our minds filled with the dust and worry of trifles. Even the railway or the motor, which carry us away from men and towns, must be left behind before we can get back to Mother Earth and hear again the voices of trees and the birds, and enjoy the soothing green of the landscape, and become sensitive to that quiet sympathy of the earth which true lovers of Nature never fail to receive. In this clamorous age it becomes more and more important to preserve and to cultivate this love of Nature—this primitive sympathy and sense of oneness with the life and movement of the earth; and therefore the literature and the art which keep us in touch with Nature are of peculiar and priceless value, with all that informs us of her wonders, that presents to us the never-ending drama of the seasons, and the quiet persistent life of plants and animals, that unfolds to our minds the marvellous spectacle of constant evolution and transformation in the great unfathomable scheme of the universe.

WALTER CRANE.

HOW TO KNOW THE WILD ANIMALS

THE BROWN TYPE OF LONG-TAILED FIELD-MOUSE.

THE MICE OF THE FIELD—I

By DOUGLAS ENGLISH, B.A., F.R.P.S.

Author of "Wee Tim'rous Beasties," etc.

Illustrated from Photographs by the Author

" There is not one student, no, not one man in a thousand, who can feel the beauty of a system, or even take it clearly into his head; but nearly all men can understand, and most will be interested in, the facts which bear on daily life."

I PROPOSE, in writing these articles on the smaller British animals, to employ the names that are in general use, and to confine myself to the life-history and life-habits of my subjects, and only to touch incidentally on their structure. To the serious student a certain museum knowledge is essential—the more, indeed, the better; but it cannot be too clearly emphasised that in the case of the animals inhabiting these islands, nearly all of which may fairly be termed common in one part or another, it is the life-histories and life-habits that require working out. Their structure and their relationships have already been deeply investigated either in this country or abroad, and those who would become acquainted with the results of these investigations should consult the transactions of the learned societies.

If, however, we regard our animals as living, breathing, feeding, sentient beings, we find that singularly little is known about them, and that, as a natural consequence of this, singularly little is known of the adaptation of their structure to function and environment. In this direction the biologist is at a standstill for want of facts.

It must not be forgotten that the observation of animals' habits is extremely difficult—more difficult, for example, than the observation of the habits of birds and insects.

The difficulty arises from several causes. The majority of British animals are nocturnal—or at least twilight—animals, and pass the daytime sleeping (?) under cover. Most are of small size; indeed, with the exception of the deer, all British land animals *feræ naturæ* may be described as small. I do not forget the otter, badger, and fox; but my own experience, and, I believe, the experience of most

people, is that the first sight of these creatures at large is disappointing. One's fancy had conceived them bigger. Bad drawing in the natural history illustrations

THE RED TYPE OF LONG-TAILED FIELD MOUSE.

is largely responsible for this disappointment, and, to some extent, over-stuffing in the museums.

Taxidermy has undoubtedly improved in recent years. There are certain subjects, however, notably mice and such small deer, which are, and always will be, beyond the taxidermist's art. Nor do I consider taxidermy at its best of much real value. A series of photographs and skins will provide most people with a better, because truer, conception of the living animal.

Apart from their nocturnal habits and small dimensions, the difficulty of studying the life-history of British animals is increased by the fact that their breeding quarters are, with few exceptions, completely hidden.

The Squirrel, Dormouse, and Harvest Mouse alone among our land animals construct their nests above ground level. The Marten may build (not adapt) a lofty nest for breeding (I know no record of it), but with this one possible, and three certain exceptions, no land animals' nest in this country is normally so situated that one can observe it through a telescope. Nor are animals' nests, when discovered, of the same convenient shape and obvious construction as those of most birds. They are spherical —not hemispherical; and, even in the case of the Harvest Mouse, there is small evidence of the material being interwoven designedly. Animal architecture is of a primitive kind. The animal collects a mass of material, dives into the middle of it, and by biting here and pulling there, and continually turning over and over, fashions a sphere around itself. All kinds of material are utilised: leaves, grasses, moss, wool, and such like; and one can usually distinguish the soft inner lining of the nest from its more substantial shell. I fancy that most Mice construct this lining by nibbling and splitting portions of the outer wall, but I have not been able to satisfy myself of this.

Each time the animal leaves its nest it makes a fresh exit, which closes by its own elasticity. This serves a double purpose where the young are concerned: it renders them invisible from without, and it keeps them warm by trapping some of their mother's heat. The difficulty of rearing a foundling hairless Mouse lies not so much in feeding it continually as in warming it continually.

Having discovered an animal's nest, one's natural impulse is to examine its contents. This impulse must be checked. However gently you disclose the babies, however gingerly you handle them, however neatly you replace them, the mother scents intrusion. She takes the first clear chance of moving. I have had this baffling experience with Hedgehogs, Moles, Shrew Mice, Dormice, and Meadow Mice. In the last case I witnessed the move. The youngsters were nipped by the scruff of the neck and dragged off one by one. This, I believe, is the usual method of transport, the choice between carrying and dragging being only limited by the size of the babies. There are records of it in connection with nearly all our animals, which are corroborated by the behaviour of one of my Field Mice in captivity—a shy, wild thing, who produced her litter within a few hours of capture. I took the young from her (there were five in all) very shortly after their birth, and handed them back singly. She took each

in her mouth in turn (her eyes were wonderful), and carried it back to the nest. A few hours later she had shifted family and nest from the south-west corner of the cage to its north-east corner. She had done her best.

It will be allowed, I think, that the difficulties of observing the growth of young Mice under absolutely natural conditions are extremely great, if not actually insuperable. Under artificial conditions something can be done, and the following notes on another Field Mouse family may perhaps be taken as typical of the early stages of Mice in general.

I have found the growth of infant Meadow Mice, Harvest Mice and Dormice in captivity to proceed on similar lines.

March 23rd, 1907. Five Long-tailed Field Mice born. The pair (this refers to the father and mother) sit on their family. Infants cling to mother when she jumps. Very small, pink, hairless, semi-transparent, blind, deaf.

March 28th, 1907. Young Field Mice now blue-grey above (the blue-grey of a dark, clean-shaven man), pink underneath, feet whitish, still partially transparent, hairless, blind, deaf.

March 31st, 1907. Brownish down visible on head, neck, and shoulders. Ears flattened to the head, but showing the commencement of the conch. Fore-limbs large in proportion. Belly and legs naked. Blind, deaf. Blackish area sharply defined from pink flesh of muzzle, where bristles are sprouting. Tail longer, but very short compared with adult's.

April 1st, 1907. Brownish hair (yellowish brindle) everywhere except belly. Still blind and deaf.

April 3rd, 1907. Mice haired all over; still blind.

April 4th, 1907. Mice still blind, but fairly active on their legs. A strong demarcation between the sepia of the upper parts and the white of the lower. Took one from mother and placed at farther corner of the cage. It headed straight back. By scent?

April 7th, 1907. Mice opened eyes.

There are two interesting points in connection with these notes which are transcribed *verbatim*. The first is the length of time during which these young creatures remain blind, or at least with their eyelids tight-closed, and the second is the extremely rapid growth of hair when it has once started.

As a preliminary to considering our British Mice in detail, it will be best, I think, to deal with them shortly as a group, and to point out some simple external differences by which the various species can be distinguished.

The Mice belong to the vast family of gnawing animals (Rodents). It is a family which embraces perhaps a thousand species, but which, in point of individual size, would appear to have passed its prime. There are few, if any, existing rodents that would be a fair fighting match for their ancestors. The palæontologist tells us of a Giant Beaver; of a Megamys, a "master-great" Mouse as they would put it in Suffolk, nearly as large as an ox; of a Maltese Dormouse weightier than a Guinea-pig. It may be worth recalling that in the case of existing animals whose pedigree is traceable, decrease of size since prehistoric times is the exception rather than the rule. The Horse has sprung from a dwarf ancestor; so has the Rhinoceros; so has the Elephant. Huge forms existing in the past

THE HARVEST MOUSE.
The 3-pattern of white on the upper lip is characteristic.

seem to have found the world too small for them. The largest Whales are larger than any extinct animal known; but they, of course, have full space to turn in, and it would seem that for a land type to be persistent it must be modest in its claim for space. In their adaptability to tree, or ground, or river as a habitat; to fruit, or fur, or feather as a food; and in their modest dimensions, we have the secret of the permanence of Mice.

AN OLD DORMOUSE.

There are four good species of Mice on the mainland of Great Britain which may fairly be reckoned "Mice of the field"—the Long-tailed Field Mouse, the Harvest Mouse, the Short-tailed Meadow Mouse, and the Red-backed Meadow Mouse. Only one of these—the Long-tailed Field Mouse—is found in Ireland. The Orkney Islands possess a Meadow Mouse of their own, and several other islands round our coasts present, as might be expected, more or less "good" variations from the mainland type.

I propose to include the Dormouse under the same heading, as, although his position is not clearly defined, he is distinctly mouse-shaped, and he is considered nowadays to have more of Mouse than Squirrel in him.

These five Mice are easily distinguishable in the adult state. For a novice confronted with a strange Mouse, the simplest method of identification is to consider (1) the tail, (2) the head, (3) the colour.

In the case of the tail, it is the length compared with that of the head and body together that is most important. Taking the length of the head and body as unity, the tails of the five species work out on an average as follows:—

	Head and Body.	*Tail.*
Long-tailed Field Mouse	1	·95
Harvest Mouse	1	·8
Dormouse	1	·8
Red-backed Meadow Mouse	1	·4
Short-tailed Meadow Mouse	1	·25

There are distinct differences, moreover, in the structure.

That of the Long-tailed Field Mouse tapers gradually to the tip. The root-end and the greater part of its length is scantily haired, so that the "rings" are plainly visible. Towards the tip the hair grows somewhat thicker.

That of the Dormouse is stout and cylindrical and heavily haired throughout—bushy, in fact. The hair grows on it in a series of whorls, and its under surface presents, in a good light, a distinctly banded appearance.

That of the Harvest Mouse is haired throughout, and rather square in section. The under surface is distinctly flattened. The last quarter inch, the chief prehensile portion, is more fleshy and more flexible than the remainder.

That of the Red-backed Meadow Mouse is haired throughout, tapers but little, and

ends rather abruptly, though the long hairs at the tip are somewhat deceptive.

That of the Short-tailed Meadow Mouse is of similar structure, but can easily be distinguished by its shortness. It is often carried in a stiff down-curve.

Except in the case of the Dormouse, there is a sharp demarcation between the dark upper surface of these tails and the light under surface.

Taking the heads next, we find that the common House Mouse type is best represented in the Long-tailed Field Mouse, whose thinly-haired ears project boldly from the surrounding fur. In size of eye the Dormouse comes first, with the Long-tailed Field Mouse a good second. The eyes of the other three species are comparatively small, and, generally speaking, their heads and faces are superficially alike.

Colour alone is hardly a reliable guide, nor yet is size, unless one is certain that the Mouse examined is full grown. The colour of all Mice varies with their age, with their sex, with their surroundings, with the climate, and with the season of the year.

The under surface of the Long-tailed Field Mouse is often pure white, and that of the Harvest Mouse invariably so. In the case of the latter a tongue of white fur which stretches from the upper lip towards the eye is in itself sufficient to determine the Mouse's identity. There are traces of this marking in the other species, but in none of them is it so clearly defined.

There is considerable variation in the under surfaces of the two species of Meadow Mice. The Short-tailed Meadow Mouse is usually smoke-grey beneath, while the Red-backed Meadow Mouse inclines to cream colour.

The Dormouse has a white patch on the throat, but his stomach is a pale copy of his back, the transition from light reddish brown of the former (distinctly the lightest of the five Mice under consideration) being very gradually accomplished.

DOUGLAS ENGLISH.

THE DORMOUSE.

Landed after leaping upwards. The grasping character of the fingers and toes is noticeable. The "thumbs" are rudimentary, but their office is performed by the large pads adjoining them. The "great toes" are fairly well developed.

HOW TO KNOW THE CLOUDS

By WILLIAM J. S. LOCKYER, M.A., Ph.D., F.R.A.S.

Illustrated from Photographs taken by the Author

I

"Men judge by the complexion of the sky
The state and inclination of the day."
SHAKESPEARE (*Richard II.*, iii., 2).

THERE is no more interesting a branch of Nature Study than the observation of clouds, and the advantage of such a pursuit is that one has not to journey to any particular place, but can remain exactly where one happens to be, and view the masses of vapour in their varied colour and form as they pass majestically overhead.

From the earliest times man in all lands has interested himself in the appearance of the sky, and, after all, was not this most natural, considering that he was solely dependent on its aspect for any indication of prospects of fine or bad weather? In those days postal arrangements were slow or non-existent, telegraphs were unheard of, and meteorological offices or bureaus had not been formed. Man was dependent on his own observations and deductions, and the approach of cyclones and anticyclones, small and large swirls of air, which, as we now know, so dominate weather in many parts of the world, could only be foretold by him from the aspect and sequence of changes in the sky over his head.

The sailor, no less than the agriculturist, had to be a close observer of the sky, for he was obliged to take advantage of, and make the best use of, the opportunities of fair weather to take him to his destined port, for in those days his craft was frail and, comparatively speaking, a veritable pigmy. It was from such people that the interesting old weather-lore originated, and they put the results of their observations into rhyme to popularise them, and render them more easy to remember. A collection of these will be found in Mr. Richard Inward's excellent volume, entitled "Weather Lore."

It is important to remember that weather is very different in different parts of the world. The sky signs applicable in one region may forebode quite dissimilar weather conditions in a more distant country, as, for instance, Great Britain and India.

It is for this reason that the old weather prophet of one region was never considered of much value when he attempted to make forecasts in another and more remote district, and this indicates why in early days much more faith was placed in the man on the spot, the local man, who had lived there most of his life, than in any newcomer, however proficient he may have been in his own neighbourhood.

There is, however, no doubt that the close study of the forms and behaviour of clouds is one of great utilitarian value, and should play, if it does not already, an important part in the science of weather forecasting. One of the great advantages of cloud observations is that we are able to see for ourselves the actual movements of the air in the upper reaches of our atmosphere, at heights which, until quite recently, were not reached by any human apparatus. The employment of *ballon-sondes* and kites has now brought not only moderate but very great altitudes within reach of meteorological instruments; but even still we shall have to depend very much on clouds at these elevations, because

instruments cannot be permanently located there.

Further, clouds at high altitudes tell us something more than the actual direction of the air currents. Their formation and dissipation indicate to us some of their physical conditions as regards temperature, moisture, etc., which are of great importance in the study of the inner working of our atmosphere.

Besides the utilitarian there is the picturesque and poetic side to the observation of clouds. Who in a moment of idleness has not turned his eyes skyward and watched the varied shapes and colours of the vaporous travellers in the ocean of air wending their way towards the distant horizon? The reader has, perhaps, watched the hatching and growth of a storm, such as that so excellently described by Lucretius in the following lines:—

" Now clouds combine and spread o'er all the sky,
When little rugged parts ascend on high,
Which may be twined, though by a feeble tie;
These make small clouds, which driven on by wind,
To other like and little clouds are joined,
And these increase by more; at last they form
Thick, heavy clouds; and thence proceeds a storm."

"CLOUDS THAT ENVELOPED THE MOUNTAIN TOPS."
View from the top of the Esel, a peak of Mt. Pilatus.

Clouds have naturally fascinated the minds of many painters, but how few of these have been able to portray faithfully the majestic nature and unquestionable beauty displayed by their subject. The painter is undoubtedly handicapped by their fleeting nature, and he can only put on his canvas an impression made up from his recollection of the scene, assisted by notes written down at the time.

The photographer is perhaps in a worse plight, for although he can secure instantaneously a faithful record of the cloudscape before him, the resulting picture lacks life, because it is devoid of the

most important feature of the scene—namely, colour.

The day, however, is not far distant when, owing to the researches of a long list of ardent workers, true colour photography will be an accomplished fact. Then, and then only, shall we be able to depict faithfully and instantaneously both the forms and colours of the sky and clouds. Each of us will be able to secure and cherish our own gems in the nature of brilliant red sunsets or golden dawn effects.

To return, however, to the utilitarian side of the subject, it is proposed here to consider only the question of the appearances of the different kinds of clouds, and so help the reader that he may be able to recognise and correctly name them himself, preparatory to comparing their appearance with the actual or subsequent weather conditions experienced.

Perhaps it is hardly necessary to state that numerous classifications of cloud forms have been suggested from time to time by those who have gone deeply into the subject. As far back as the year 1803, Luke Howard was one of the first who brought out a system of nomenclature—and this was so good that it held first place up to quite recent years. Many other attempts at a more scientific classification have also since that date been made, but the majority of them, with perhaps the exception of that of Clement Ley, were simply makeshifts.

The reader will quite understand how important it is to have *one* classification, because, with many current, the same type of cloud could be, and was, called by several different names. It was hopeless, then, to discuss from a scientific point of view the observations of several workers, since the nomenclature in many cases was so different.

The question was, however, settled by the International Meteorological Committee, which specially appointed a subcommittee to report on the various classifications in use, and to devise a more simple and efficient system. The result of this step was that an international system of cloud nomenclature was agreed to by the heads of all the meteorological institutions throughout the world. Not only this, but an international cloud atlas, with text in English, French, and German, was soon published, and is now in general use wherever scientific observations of clouds are made.

Before stating the details of this classification, it is as well to become familiar with three conspicuous forms of cloud-structure which are quite distinct in appearance. Perhaps the most common form of them all is that which has a heaped-up appearance, lumpy, in fact, with the under surface more or less horizontal. This form of cloud is sometimes very striking by reason of the great thickness in its vertical direction, and it occasionally puts on the appearance of an enormous cauliflower. This form of cloud is termed *cumulus*.

In great contrast to this, we have a form of cloud which arranges itself in long, horizontal sheets or layers. In this case the vertical height is insignificant compared to its great extension in the horizontal direction. The name given to this shape is *stratus*.

The third and last prominent form is that which presents a hairy or fibrous appearance. It is usually very delicate in structure, and sometimes takes the form of feathers stretching across the sky, occurs only at high altitudes, and is known as *cirrus*.

When the reader has well mastered these three main varieties of cloud, he has a firm basis on which to class the other manifold characters which the clouds at times assume, since they are all simply stages of gradation between those types.

It must not be forgotten, however, that clouds are formed at nearly all altitudes. Sometimes they are actually on the ground, when they are called mists or fogs. Sometimes, again, in mountainous districts they are seen to enwrap for a time the mountain peaks. We observe such clouds in the illustration on page 9, which, as they passed the mountain top from which this view was taken, enveloped it in a thick mist for the time being. The mountain in question was the Esel, one of the peaks of Mount Pilatus, near Lucerne. This peak rises 6,962 feet above sea level, and the small bundles of cloud visible near the middle of the picture are just about to obliterate the view of the town of Lucerne,

which can just be seen in the distance above their tops.

At other times clouds attain such tremendous heights that it seems almost impossible to form an estimate of their elevation. The upper clouds are a most important factor in the science of weather forecasting, and their use for this purpose has been noticed from very early times, and handed down to us in one of many of the old sayings, " the higher the clouds, the finer the weather."

By means of careful measurements with appropriate instruments, the heights of various types of clouds have been accurately determined. On the basis of these data three layers, so to speak, have been adopted—namely, the upper, the intermediate, and the lower layer. The average height of the upper layer is taken as about 9,000 metres, or about 30,000 feet. The intermediate extends from about 3,000 to 7,000 metres, or it may be said to have a mean height of 5,000 metres, or about 16,000 feet. The lower layer has a height of 2,000 metres, or 6,500 feet.

In cloud classification, the nomenclature is so adopted that in addition to the form of the cloud the height is always included. This procedure is found most useful, because the same form of cloud frequently occurs at different levels.

Broadly speaking, it may be said that clouds in the upper layer may be identified by the prefix *cirro* to their type, and those in the intermediate layer by the prefix *alto*. In the lower layer no prefix is necessary, but the clouds assume their single names—*i.e.*, *cumulus* and *stratus*. The above, however, is not strictly true, but may be taken as a second step towards mastering the adopted international scheme, which is as follows :—

A.—*Upper Clouds* (average height 9,000 metres).
- *a* 1. Cirrus.
- *b* 2. Cirro-stratus.

B.—*Intermediate Clouds* (between 3,000 and 7,000 metres).
- *a* 3. Cirro-cumulus.
- *a* 4. Alto-cumulus.
- *b* 5. Alto-stratus.

C.—*Lower Clouds* (2,000 metres).
- *a* 6. Strato-cumulus.
- *b* 7. Nimbus.

D.—*Clouds of Diurnal Ascending Currents.*
- 8. Cumulus.
- 9. Cumulo-nimbus.

E.—*High Fogs.*
- 10. Stratus.

If this classification be carefully examined it will be noticed that the words *cumulus* and *stratus* are used to define the form that clouds assume at even high elevations. Thus, for instance, if one observes *cirrus* cloud—that is, cloud say five miles high—and it appears in the form of sheets, it is termed *cirro-stratus ;* while if it takes the form of small, lumpy masses, as in the case of mackerel sky, it is called *cirro-cumulus. Cirro-cumulus* does not, however, occur at quite so great an elevation as the *cirro-stratus*, and so is classed at the head of the intermediate layer, as will be seen from the foregoing classification.

Two other points in the classification require, perhaps, further explanation. The first is the term *nimbus*. This name simply implies a *cumulus* cloud from which rain or snow is falling, and is generally a very thick, dark cloud. The second point refers to the small letters *a* and *b* before the cloud names. The former means that the clouds are in separate or globular masses, which is generally the case in dry weather ; while *b* indicates that the forms are widely extended or completely cover the sky, as in wet weather.

Let us now take each of the types of clouds in turn and, where available, illustrate them by photographs, so that a typical picture may be retained for purposes of reference. It must, however, be borne in mind that the varieties of cloud forms are really innumerable, and that no two pictures of the same kind are alike, for, as already pointed out, there are all stages of change from one type to the next.

To begin with, let us start with the high or upper clouds, which consist of the *cirrus* and *cirro-stratus* types.

Cirrus clouds are of a fibrous or feathery nature, and sometimes these feathers stretch right across the sky, apparently converging towards the horizon as a result of perspective. The illustration on this page is a good typical example of such clouds. In this picture the observer is looking due west, and the sun is well down towards the horizon. The photograph was taken on October 23rd, 1906, at 4.30 p.m., at South Kensington, and the towers seen are a portion of the Natural History Museum. From the lie of the clouds it will be noticed that the direction of the wind in this elevated region can be estimated.

CIRRUS CLOUDS.

Photographed at South Kensington at 4.30 on an October afternoon.

Sometimes cross currents invade these regions, and the thin, fibrous-like clouds are drawn out into fantastic shapes. The photograph at the bottom of page 13 illustrates such a case, and is from a photograph taken from the same spot, only looking southward, on September 24th, 1906, at 3.45 p.m. Here we see

CIRRO-STRATUS CLOUDS.
This type appears here as radiating from the horizon. The small, white, fluffy clouds are cirro-cumulus. Photographed at South Kensington on a June afternoon.

CIRRUS CLOUDS.
The fantastic shapes are due to different air currents. Photographed at South Kensington on a September afternoon.

the filaments twisted and twirled about as if the sky had been smeared here and there.

It was evidently such a scene as this that is referred to in the old weather-lore saying :

"Trace in the sky the painter's brush,
The winds around you soon will rush."

and in order to screen the lens from the sun, which was right in front of the camera, a shade was held over the objective. Although the greater and more distinct portion of the cloud in the picture is alto-cumulus, the cirro-stratus will be observed in streaks radiating from the horizon-like spokes from the hub of

CIRRO-STRATUS CLOUD FORMING A SOLAR HALO.

This photograph was taken in the same direction but a few minutes after that reproduced at the top of p. 13.

At these altitudes we find also the cirro-stratus clouds. This consists, as a rule, of a thin, whitish layer, which at times covers the whole sky and makes the sky appear whitish instead of blue. Such a cloud is responsible for the beautiful halos—sometimes single, sometimes double—which are seen at times encircling the sun with radii of different lengths.

Such a cloud does not lend itself at all to photography. At times, however, it is not homogeneous, but presents the appearance of straight streaks, which converge towards the horizon or a tangled web. It is then that the camera can be used with effect, as the photograph at the top of p. 13 will show. This was secured on June 23rd, 1907, at 1.23 p.m., at South Kensington. The camera was pointed in the direction of south-west, a wheel. As the wind, which was strong at the time, was south-west, both types of cloud gradually passed overhead. Eventually the alto-cumulus passed nearly out of the field of the camera, as can be seen from the illustration on this page, while the cirro-stratus was still blowing up. The latter was the cause of a most brilliant halo, which is depicted in this illustration, the camera not having been moved between the two exposures. The streaky appearance of this halo is due to the stripy nature of the cirro-stratus. The position of the sun can easily be determined by finding the centre of the circle which forms the halo.

It seems to have been generally conceded that solar halos indicated the advent of wet weather, for one old saying runs as follows :

"The circle of the moon never filled a pond;
The circle of the sun wets a shepherd."

While another states:

"The bigger the ring, the nearer the wet."

Whether this is borne out by modern statistics I am not prepared to say, but the only two halos I have photographed were followed by fine weather the next day.

WILLIAM J. S. LOCKYER.

HOW TO KNOW THE WILD FLOWERS

By the REV. H. PUREFOY FITZGERALD, F.L.S.
Illustrated with Photographs by HENRY IRVING

THE FLOWERS OF THE WAYSIDE—I

WITH the supposition that everyone (and I imagine there can be very few exceptions) who takes a ramble in the country, likes to know the names of the common flowers he is likely to meet with and to understand a little about their life-histories, their romances, and their strivings in the great battle for existence, the intention of these chapters is to serve as an introduction. It has been said that "a little learning is a dangerous thing," and in some instances, undoubtedly, this is true; but often the reverse is the case, and a little knowledge of common wayside objects, flowers, birds, insects, or whatever they may be, does add to the interest of life to a surprising extent. At any rate, a country walk need never be dull. There is always something to attract the attention; to divert one's thoughts into other paths, for even the smallest and most insignificant object in creation is capable of imparting a store of knowledge, if only the eyes are open to see and the heart ready to receive.

Be it understood, then, that the study of botany is not the intention. Botany—that science which, to the beginner, would appear to be a store of difficult and incomprehensible terms, which have set a great many against it, and often made the would-be lover of flowers hate the very sight of them. It is not given to all to wish to be botanists, but there is implanted in everyone a love of Nature, and especially a love of the flowers which brighten to such a degree the face of the earth. Most people like to gather them and to have them near for the sake of their cheerful company and pleasing scents; at the same time, it is somewhat dull to be surrounded by companions whose very names are unknown, and to be ignorant of any small points of interest connected with them; not to understand why one flower is formed in this shape and another in that; why one plant grows tall and another lies flat on the ground; and some of the various ways in which Nature, after many hundreds of years' experience, has adapted each one so that it may the more surely reproduce its own species. A great deal of this can be readily understood with a little knowledge, and so much interest may be awakened that it may prove to be but an incentive to understand more about the hidden mysteries of the world.

Under separate headings, then, the more common flowers of the wayside, woodlands, hedgerows, corn-land, and so on, will be here dealt with in turn. The photographs will, so far as is possible, show the plants growing in their natural haunts; and these, it is hoped, will enable the rambler in his walks to identify the flower, by showing the mode of growth, the form of the blossom, the shape of the leaf, and the general appearance. The descriptions are not intended to form a botanical guide; if this

LESSER CELANDINE.

special knowledge is required, it must be sought for in one of the many handbooks to the British flora. Their object is to point out any special feature which may assist in the identification, and to set before the reader any facts of interest which may be seen in the growing plant or which pertain to it, such as the explanation of a peculiarly shaped flower or leaf, the origin of its name and so on.

One of the most fascinating studies in plant life is that of fertilisation. Each blossom appears to have been gradually brought into its special shape with a view of securing, in the best manner possible, the transference of the yellow dust (the pollen) from the male portions, the stamens, to the female organ, the pistil. But Nature abhors self-fertilisation — that is, the act of fertilising a flower with its own pollen; many and varied are the means by which this is either wholly or partly prevented. Insects of all kinds are called in to assist, special precautions being often taken to keep out unwelcome guests; whilst the colours, scents, and the store of honey all serve as attractions. The brightly coloured flowers are visited by day-flying insects, bees being among the most welcome; while the night-blooming plants are generally white and very fragrant, whereby moths are attracted to them.

Again, there are many different ways by which a plant is able to disperse its seed; in some cases, as in the Dandelion, a light, feathery pappus or down is attached to each seed, so that the wind will catch it and blow it away until it at last finds a rest in what may be a favourable spot for germination. In other cases some mechanical explosive device is adopted, the walls of the seed vessel, as it ripens, being drawn together under great tension, and then, when the state of the atmosphere is most favourable, the explosion suddenly takes place, and the seeds are shot out in all directions.

Features of this sort will be mentioned and briefly explained, in the hope that the reader will turn his attention to these little details and verify them for himself. To all those who will try to unravel the secrets of the plants, I can promise the gradual unfolding of a wonderful world; mysteries, hidden to the uninitiated, will

begin to reveal themselves, and the whole of the countryside will be found to be teeming with interest.

THE LESSER CELANDINE

One of the earliest of plants to unfold its bright blossoms and to remind us of the coming of springtime is the Lesser Celandine, covering the ground beneath the hedges, with its dark green, shiny heart-shaped leaves and its bright yellow flowers. Its name, *Ranunculus ficaria*, tells us that it is a very near relation to the Buttercups; the Latin *rana*, a frog, gives rise to the first name, since this plant delights in the damp situations which frogs are also fond of frequenting; the specific name, *ficaria*, comes from *ficus*, a fig, and if you will dig up a plant, you will see that the roots consist of several little tubers, somewhat resembling figs in shape. Examine several of the flowers, and you will find that each one possesses three sepals, the small green leaf-like appendages at the back; but the number of shining yellow petals varies from six to ten, or even more. There are also numerous stamens, surrounding the central portion of the flower, which consists of several carpels arranged in a globular head, each of which contains the embryo of a future seed. The head of each stamen is enlarged, and forms what is botanically termed the anther; inside this the yellow fertilising dust, or pollen, is produced, and presently liberated, some of which must eventually find its way to the sensitive stigma at the top of each carpel before any seed can be borne; here it will be induced to send out tubes to the young embryo seed, down which will flow the fertilising fluid.

The Lesser Celandine must not be confused with the Greater Celandine, a plant which grows in the hedges and flowers about May, and which is, in reality, a kind of Poppy. These two can be easily distinguished, as the latter has four yellow petals only and much bigger leaves, and it does not flower until later in the year.

SILVERWEED

One of the most common plants to be found by the roadside is the Silverweed

SILVERWEED.

(*Potentilla anserina*), which, by the beauty of its silvery leaves and large flowers, is sure to attract the attention of the passer-by. The leaf, as the photograph shows, is of a feathery, or pinnate, form, and it is closely covered with a silky, white down, especially underneath, whilst each

fancy that geese are fond of grubbing it up and eating the roots. Other common names are Goose Potentil and Prince's Feather.

BARREN STRAWBERRY

The Barren Strawberry is another of the same family, its botanical name being

BARREN STRAWBERRY

large, yellow blossom is borne on a somewhat long stalk. The plant spreads rapidly by means of creeping runners, much in the same way that the Strawberry does, and may be seen in flower during May, June, and July. To be seen at its best, it should be looked for in damp, poor pasturages; those found by the dusty roadsides generally are not so well developed. The flower will be found to have five yellow petals, and twice as many green sepals behind. The name *Potentilla* is derived from the Latin *potens*, powerful, as some of the family were formerly supposed to have strong medicinal properties; *anserina* comes from *anser*, a goose. Exactly why it was so called I cannot say for certain, but I

Potentilla Fragariastrum. You must be careful to distinguish this from the Wild Strawberry (*Fragaria vesca*), for which it is very often mistaken, since the general habits and the leaves and flowers of both plants resemble each other very closely. In the Barren Strawberry the petals are generally somewhat shorter than the divisions of the calyx (the sepals), and the whole blossom is smaller than that of the Wild Strawberry; but the principal and most noticeable difference lies in the fruit—in the former, this does not swell or become succulent, but is always hard and hairy, and as the fruit and flower are very often to be found on the same plant, it is easy to distinguish it. The Barren Strawberry begins to flower about March, and

goes on till May or June, while the Wild Strawberry is seldom found blossoming before May, and continues more or less throughout the summer.

THE GREATER STITCHWORT.

Towards the end of April, the Greater Stitchwort, or Starwort (*Stellaria Holostea*) begins to put forth its white, starry blossoms. This plant is one of the Pink family (*Caryophyllaceæ*), the members of which are herbs having round, jointed stems, with a thickening at the junctions, called nodes; the leaves are arranged in pairs, situated opposite each other, with smooth edges. If you look carefully into a Stitchwort blossom, you will see that there are five green sepals, five deeply divided white petals, ten stamens, and three styles. (A style is the stem of the pistil, the female portion of the flower; at the base of the style is the ovary.) Some of the members of the Pink family have their different parts arranged in fours, instead of in fives; but in all of them the petals possess a broad blade, while the lower portion is narrowed down to what is termed a "claw." In the Stellaria five of the stamens become elongated soon after the flower opens, and incline towards the centre, so as to be well in the way of the body of any insect flying on to it in search of honey; these wither, and then the second set of five stamens mature. In the third stage the pistils rise and expand their sticky, sensitive surfaces (called the stigma), and they do this in time to rub against the latest matured stamens, so that in case no insect visits and fertilises the flower by bringing the pollen from another plant to the stigmas, self-fertilisation takes place; these different stages can readily be found, and may often be seen on the same plant. The old herbalist, Gerarde, says that this plant was called Stitchwort, because a decoction of it was used to cure a stitch in the side.

GREATER STITCHWORT.

H. PUREFOY FITZGERALD.

HOW TO KNOW THE BIRDS

By the REV. MAURICE C. H. BIRD, M.A., M.B.O.U.

Illustrated with Photographs by
RICHARD AND CHERRY KEARTON

I.—A GENERAL SURVEY

YOUNG RED-BACKED SHRIKE.

IT is a remarkable fact that even the inhabitants of our country villages, every one of whom probably has done more or less birds'-nesting in their youth, are nevertheless unable to mention by name—much less to identify by sight—a round score out of the 400 and more birds that are enrolled upon the British list. Some may know "a Hawk from a Harnser," (Heron), but, as a general rule, if all their Geese are not Swans, all their Martins are Swallows, and all their Rooks are Crows, and that without any intentional reference to scientific accuracy.

It is only within recent years that any active intelligent interest has been taken by the general public in any branch of natural history. Now, thanks greatly to the Nature Study movement having been introduced into our schools, the rising generation is being encouraged to use and improve its powers of observation, to the exploding of many a former popular fallacy.

But although it is now well known that the Cuckoo does not turn into a Hawk in winter, and that many birds, which once, in different phases of plumage, were supposed to belong to distinct species, are mere sexual or seasonal variations of one and the same species, still, each succeeding year, nearly, adds a new name to the catalogue of our occasional feathered visitors, so that it becomes increasingly difficult to identify with certainty the birds of our rambles. Who has not been puzzled by verbal descriptions of birds? A friend, full of excitement, comes and tells you that he has seen a bird, the like of which he is quite sure that he has never seen before, and in his eagerness to describe it to you exactly, he paints a lengthy word-picture, suggestive of an ornithological rarity. He gives you details of size and shape and colour, which in one or other particular might be applicable to several species. You give your informant credit for some knowledge of all the commoner forms of local bird life, and cast about in your mind's eye for the most likely casual visitor to fit in with the most salient points of his picturesque description, and finally are obliged to arrive at the conclusion—much to his disappointment certainly, and your own too, perhaps—that he has, after all, merely come across a veritable commoner, but at an unusual season of the year, or in an unexpected locality—a Reed Bunting in a stackyard, or a Jack Snipe in July.

Even with a bird in the hand, specific, sexual, seasonal, and age-distinguishing marks are often both small to behold, and difficult to describe, without a knowledge and use of scientific terms. At a distance, the difficulty of identification is, of course, far greater, especially when the observer is ignorant of what characteristic feature or flight, note or attitude, to look out for. Nor is it easy to lay down any hard and fast rules by which to aid the tyro outdoor student of British birds

to recognise, at sight, the various flitting forms of feathered life, which one may

SWALLOWS ON A TELEGRAPH WIRE.

chance to meet by land or water throughout the year.

It is impossible to draw a strict line of demarcation between birds of the sea, sky, or trees, or those frequenting sand, mud, or rocky shore. If we attempt to classify, either by approximate size, general coloration, formation, or manner of flight alone, inevitable confusion awaits us; and even if we heard the note of every bird we saw, and could copy it sufficiently well to satisfy ourselves, we should be met with the difficulty that all people do not hear exactly alike, and therefore we might not be able to convey to another the information that we desired. There are, of course, many birds which, once identified, could not possibly, in note or appearance, be again mistaken; but on the other hand, there are also many which so closely resemble one another, that very careful and minute examination is absolutely necessary before we can determine the species, whilst in others the dissecting knife alone can declare the sex.

The following remarks, then, by no means pretend to form a precise and all-sufficient guide to the identification of birds, but are intended only to afford some hints and suggestions which may prove useful in assisting to name the commoner birds of our country. It will be as well in the first place to say a few words about those bodily parts which all birds possess in common, and to remember that "use increases, and disuse decreases parts," from which we may infer that the special development or modification of the legs or wings, feet or beak, of any given bird will tell us something of its life-history, habits, and habitat, and thus help us towards its identification.

Thus those birds which spend most of their time in the air, and procure their food whilst flying, will be found to possess highly developed wings. Of such birds the Swallow tribe afford a striking example. Those which seldom fly, and procure their food from the ground, require feet well fitted for rapid running; hence we find the hind toe either entirely absent or quite rudimentary in such rasorial birds as Bustards and Partridges. Swimming birds, again, will be found to possess keel-shaped bodies, close, waterproof feathering, and feet adapted for paddling, webbed in the Ducks, lobated in the Grebes. Birds which wade in water for a living have long, bare legs, and comparatively elongated necks and beaks—the Curlew and Snipe, for instance. Those which prey upon others require not only great wing power, but also claws to hold and beaks to rend; hence we find that the Hawk tribe have not only the proverbial eagle-eye, but

TYPES OF SWIMMERS: MALLARD AND WILD DUCKS ON ICE.

are also highly specialised in tooth and talon; whilst their cousins of the night have acquired soft feathers for noiseless flight and powers of vision adapted to their twilight wanderings. Birds which dwell much in trees and nightly rest thereon have the hind toe and claw well developed, in order that they may securely grasp the swaying branches. Diving birds, from habits long indulged, have modified their wings to such an extent that they now serve as useful fins; whilst the tail, which would be an impediment to submerged flight, has practically aborted, as may be well seen in the Grebes. Woodpeckers, using their caudal appendage as a prop or stay whilst prospecting perpendicular tree trunks for food, have, after long ages of such action, greatly strengthened this point of resistance.

GREEN WOODPECKER.

The old Linnean system of classification, in which birds of prey head the list—divided into day and night feeders—forms, I think, the easiest form of first aid both in nomenclature and identification of species. We will therefore just run through the six great families, and then proceed to some more original sortation remarks, such as descriptions of peculiarities of shape and make, note or habit, which may assist the tyro naturalist in answering the oft-asked question, "What bird was that which I saw just now by sea marge or river side, in hedge or field or wood, or marsh or garden-grass plat?"

The Eagle is generally looked upon as the King of Birds, and the order to which it belongs ranks first in the Linnean classification to which I have referred; but, with the exception of a chance sight of a Golden Eagle in the north of Scotland, no real Eagles are likely to be met with by my readers.

All the Hawk tribe are Eagles in miniature, and two species of Hawks are more or less common in every English county—the Kestrel and the Sparrow Hawk, the former being the most frequent. How, then, may we be able to distinguish the one from the other? Chiefly from their distinctive habits.

Generally speaking, all other birds are more or less afraid of birds of prey—Eagles, Hawks, and Owls; and our attention is very likely to be first attracted to the presence of any one of them by the noisy and alarmed behaviour of what small birds there may happen to be in the vicinity. If the Hawk be a Kestrel, it may soon be identified by its peculiar though beautifully distinctive habit of hovering over open ground in its search for field mice and voles, which form its staple diet. The keen eye of a Hawk is proverbial, and rightly so, for it is so wonderfully contrived as to be equally useful for near and far sight. When, then, the hovering Kestrel (about twice the size of a Thrush), poised on motionless or rapidly pulsating wings and expanded tail, has located a mouse in the herbage below, it noiselessly drops like a bolt from the blue, clutches the prey in its talons, and either proceeds to devour it on the spot or carries it away in its talons.

In early spring the loud and penetrating call-note, or rather ringing cry, "Kli-kli-kli," frequently betrays the presence of the "Windhover"; and when once this note has been identified it cannot well be mistaken for that of any other bird. Ivy-clad ruins, church towers, dilapidated windmills and tall trees—especially in the neighbourhood of a

rookery — are the generally chosen nesting site, and although at other seasons of the year all members of the Crow family will usually mob a Hawk of any species, both Kestrel and Sparrow Hawk are allowed to nest near by a colony of Rooks in peace. In flight, all the Hawk tribe appear to possess very short necks, long wings, and tail.

The Sparrow Hawk is not so frequently seen as the Kestrel, not merely because it is not so common, but also because it does not procure its food by such comparatively slow and conspicuous methods as those adopted by the sky-scraping Kestrel. Hunting hedgerows and coppices, it boldly and suddenly makes a dash at any bird that comes in its way; nor does it hesitate to attack those larger than itself.

In all Hawks the female is larger than the male, and

SPARROW HAWK AND YOUNG.

MERLIN SITTING ON NEST.

this difference is especially noticeable in the Sparrow Hawk, the female being sometimes as much as three inches longer than her mate. The Sparrow Hawk's tail is longer in proportion to the wings than is the case with the Kestrel. If a close enough view be obtained it may be noticed that the upper surface of the body is of a light chestnut colour, whilst that of the Sparrow Hawk is a dull brown; the breast of the former is spotted and that of the latter delicately barred.

The Merlin, sometimes to be met with as an autumnal migrant, accompanying an influx of Larks, may be described as a miniature Kestrel in shape and make; whilst the Hobby is like a small Sparrow Hawk, and sometimes appears with the Swallows in spring. Game protection, however, has made it rare in England, it being the boldest as well as the smallest of our raptorial birds. Together with the far larger and equally scarce Peregrine Falcon, it has a conspicuous patch of black feathers, like a short and thick moustache, at each corner of the gape.

YOUNG PEREGRINE FALCONS.

HEAD OF PEREGRINE FALCON.

Should you happen to reside near a rocky coast and notice a large Hawk attacking the cliff-haunting seabirds, or in a marsh or moorland district and discover consternation amongst the Peewits or Wildfowl, or in a well-wooded country and find traces of havoc committed among the Pigeons, the culprit will most likely prove to be a Peregrine.

The other less common large Hawks, such as Buzzards and Harriers, generally confine their attentions to small mammals, young or wounded birds, birds' eggs, and even large insects. The Honey Buzzard obtains its name from its fondness for wasp grubs, a habit which sometimes brings a stray specimen under the observation of the roadside naturalist. It is the only British Hawk which has no patch of skin bare of feathers between the eyes and beak—a provision of nature, perhaps, to protect the nostrils from the stings of the parent wasps.

A KENTISH GARDEN.
From the Water-Colour Drawing by Mrs. Allingham, R.W.S.

The Osprey, or Fish Hawk, is so rare that we need only refer to its distinguishing features—namely, pale blue legs, feet, and cere, which in other species of Hawk are of various shades of yellow. Its outer toe is reversible, the legs are comparatively short, and the feet are prickly underneath, to assist its long and much-curved claws in holding its slippery prey; the scalp feathers are slightly elongated, and give the bird when at rest the appearance of having put on its cap with the peak pointing backwards.

A PAIR OF OSPREYS AND THEIR NEST

OSPREY.

The connecting link between day- and night-feeding raptorial birds, so far as habits, if not structure, are concerned, is to be found in the Short-eared Owl, for during the spring and summer months it much resembles the Harriers; it nests upon the ground, and may be observed hawking for prey with buoyant flight over the marshes and moorlands in full daylight. Though one of our rarer British breeding birds, its numbers are greatly augmented in autumn, and throughout the winter it is somewhat gregarious, arriving here from more northern climes at about the same time as the Woodcock.

All other British Owls—Barn, Tawny, and Long-horned (for long-*eared* is rather a misnomer, the feather tufts on the head having no connection with the ears)—are all strictly nocturnal, and hence more often heard than seen. All are specially equipped with soft plumage for noiseless flight, and all have lovely large and cat-like eyes, which they blink strangely when aroused in daylight. The Tawny or Brown Owl hoots loudly and resonantly; the White or Barn Owl, which is by far the most common, hisses, snores, and shrieks; whilst the Long-horned Owl mews and barks. The iris of the Barn Owl's eyes is black, that of the Tawny Owl dark blue, whilst in all other species it is yellow.

SHORT-HORNED OWL ON NEST.

This brings us to the end of the first great division in the Linnean list. We come next to the large group of Sparrow-like or Perching Birds, which is headed by the Shrikes or Butcher birds—veritable Hawks on a small scale, save that in neither power of flight nor vision are they so specially adapted for raptorial pursuits, their prey consisting of comparatively helpless and smaller deer. We have only two representatives of this family that are at all common, the Red-backed Shrike in summer and the Grey in winter. The latter is the larger bird, and far less frequent. The male of the former—not quite so large as a Thrush—is a lovely bird, with semi-hawklike black beak and forehead, grey hood and mantle, black eye stripe, rufous back, and black and white elongated tail, with pale grey underparts with roseate tinge on breast. These birds have a curious habit (which has won for them the alternate name of Butcher birds) of spitting spare food—humble-bees, beetles, and even mice and nestling small birds—upon the thorns of Sloe or May bushes around their nests. These larders sometimes betray the whereabouts of their somewhat roughly constructed nursery.

The Spotted Flycatcher, so fond of yearly nesting near, if not upon, the trees trained on the very walls of our houses, and whose pretty habit of hawking for flies from a favourite perch within sight of our windows renders him one of the most observed of all our summer visitors, is perhaps the last bird that has any regular method of feeding which connects him with the birds of prey, and that merely consists in the aforementioned habit of insect hawking. From him we pass on through the Thrushes, Chats, Warblers, Tits, Wagtails, and Pipits (all of which—except the Tits, who make use of their feet—have a notch in their upper mandible to assist in holding and dissecting their food), to the hard and cone-shaped beaked families of Larks, Finches, Starlings, and Crows, which we will sift later on.

The third and last division of perching birds—that is, those birds which, with few exceptions, to be referred to hereafter, have the hind toe and claw well developed for grasping the branches of trees—consists of wide gaped birds, including the Swallows and Goatsucker or Nightjar, both of which families take their food on the wing—the former by day, the latter by night. Next we come to the climbers—Woodpeckers, Creeper, Nuthatch, Wryneck, and Cuckoo, all of which have the feet especially adapted for clinging to the bark of trees.

YOUNG TAWNY OWL.

The fourth order includes the Pigeons and Game birds; the latter being practically ground dwellers (Wild Pheasants frequently preferring to roost thereon), lead us easily on to the shore birds and waders, five families of more or less long-legged birds with curiously specialised beaks beautifully adapted to the nature of their food and their

YOUNG LONG-HORNED OWL.

various methods of procuring it. All of these birds are able to swim should occasion require it; the feet of some are fitted with incipient webbing. This feature, of course, is fully developed in the true water or swimming birds, the last of the six great orders, which includes the Ducks, Geese, Swans, Divers, Auks, Pelicans, Gulls, and Petrels.

Thus all British birds may be divided into six great divisions: birds of prey, perchers, climbers, walkers, waders, and swimmers, each order being again split up into families and sub-families or species.

Before proceeding further, a word of warning is necessary as to the use of the prefix "common" in the description and identification of particular birds. At best it is of little value, and sometimes very misleading. For instance, when we speak of the Common Kite, or of the Common Buzzard, we are talking of a state of British bird life which passed away some two hundred years ago. The Common Bunting is nowhere the most common representative of its family, nor is, perhaps, the Common Gull; whilst the Common Skua is no longer, if it ever were, frequently to be found in any county; and even the Common Crossbill is comparatively rare.

MAURICE C. H. BIRD.

RED-BACKED SHRIKE ON NEST.

HOW TO KNOW THE TREES GROWING IN BRITAIN

With Notes, descriptive and photographic, for their Identification in all Seasons of the Year

By HENRY IRVING

I.—THE BEECH AND THE OAK

"What we want is the meaning, the character, the expression of a tree, as a kind and as an individual."—O. W. HOLMES.

THE particular trees of which the following chapters treat are such as may be commonly met with in Britain. Some are native, whilst some are of comparatively recent introduction, but these may be regarded as naturalised.

The descriptive notes are written from the standpoint of an ordinary observer whose interest is in the trees as living creatures, not for their commercial or other uses.

The illustrations selected are mainly those which shall best help in the matter of identification, and especially in the winter season when this is beset with the more difficulty. They comprise the winter appearance of the tree, of the twig, of the resting bud (this last enlarged somewhat so that the more minute markings, leaf scars and leaf traces, may be the better noted); the summer appearance of the leaves on a portion of the clothed twig; and, for any season, the appearance of the lower part of the trunk, showing also the surface and texture of the enclosing bark. These in their season, with such detailed aid as may be derived from the descriptive notes, will, it is believed, generally suffice for purpose of identification at any time in the year.

A note of warning is required in reference both to descriptions and illustrations. Trees are living creatures; they are not cast in moulds like iron palings. They are subject to many influences, hereditary and circumstantial. They have decided individuality. Variation may meet us at any point. No individual tree is true to type, at one and the same time, in every particular.

The main division of the trees here is into (1) broad-leaved trees (Beech, Oak, etc.), and (2) narrow-leaved trees (Pines, Firs, etc.). The broad-leaved trees are again divided into (1) those with inconspicuous flowers, mostly gathered together into catkins, lacking flower-leaves (or petals), which accept in the main the service of the wind for the conveyance of the pollen dust from flower to flower; and (2) those with conspicuous flowers, growing singly or in clusters, having petals white or coloured, secreting nectar, attractive to bees and other winged insects, to whom they look for the conveyance of the pollen as required.

It is hoped that these following notes, descriptive and photographic, will serve as aids to those who desire a closer acquaintance with our common trees; ability to distinguish one kind from another at any season; some knowledge of their individual character and habit; and, added to these, the attainment of a sympathetic regard for them, through grateful appreciation of their gentle companionship and generous service.

THE BEECH

The Beech, growing in the open, is a stately, luxuriant tree, with oval-shaped crown, and branches reaching almost to the ground. One amongst many in the forest, its stem rises as a plain column

"THE BEECH IS A MONOPOLIST . . . STAKING OUT ITS CLAIM AND HOLDING ITS OWN AGAINST ALL COMERS."

A WINTER CARPET OF LEAVES UNDER BEECHES.

some 50 or 60 feet without a branch; and its diminished crown, joining with those of its immediate neighbours, be-

tracery of finely tapering twigs on ascending branches. In young trees, and on the lower limbs of older ones, in

A BEECH IN WINTER TIME.

comes part as of a deep canopied roof over cathedral aisles. By nature it is extremely masterful, a monopolist bred and born, persistently, as it were, staking out its claim, and holding its own against all comers. It casts so dense a shadow that few plants can grow beneath it.

In *winter* the Beech shows a delicate

sheltered situations, the dry leaves of the previous summer long retain their hold, and glisten and rustle even till the new spring opens. Where the leaves have fallen the rich bronze carpet which they make under the denuded Beeches, with the grey stems of the trees contrasting, and the long shadows stealing across,

is full of warm light even in winter days.

As *spring* draws on, the tree, by reason of its changing buds, assumes almost a ruddy hue, to be followed by the pure emerald of the first unfolding leaves, till these attain full growth with deeper but yet translucent shadow.

With the full *summer* the closely-fitted mosaics of leaves, in ascending tiers, thickened and opaque, yield to the wayfarer most grateful shade as of twilight at high noon, forming under widespread expanse an oasis of coolness also amid the surrounding midday swelter. For every leaf with its shining surface throws back excess of light and heat.

In *autumn* the peculiar glory of this tree appears when, robed about with leaves whose green is changed to ruddy gold, it lightens the landscape as with a flame; on dull days fairly simulating sunshine, on bright days gathering in and intensifying the day's brightness.

It will be useful now to give some details as aids to identification. These, taken more or less together, according as they are available, will serve to distinguish the Beech from other trees in any season of the year.

TRUNK AND BARK OF THE BEECH.

BEECH LEAVES.

The *trunk* is cylindrical but broadening at the base, as with prehensile claws that grip the ground, assuring firm foothold. The *bark* is thin and smooth, and fits like a skin over moulded trunk and limb. It is olive grey in colour, almost lustrous, with exquisite gradations of tone. The winter *twigs* are smooth, of varying shades of brown, distinctly zigzag, long, and slender. The resting *buds*, placed alternately on either side of the twig, are spindle-shaped. They stand out boldly from the twig at each angle of its zigzag. They are protected with numerous firm scales of a pale brown colour. As the bud expands, putting forth its young leaves, these scales separate and fall off, as small brown caps. Beneath each bud on the twig is the small healed wound, the "scar," where the leaf of the previous year was attached. This in the Beech is elliptical in shape, and shows three small "traces" where the severed tubes that passed from twig to leaf have been closed.

The *leaves*, when first emerging, are delicately fringed with silky hairs. Later these fringes disappear. The full-grown leaf is oval in shape, and pointed somewhat, clear dark green, and glossy. It has a slightly wavy outline. The midrib

WINTER TWIG OF BEECH SHOWING RESTING BUDS.

runs in continuation of the stalk direct to the apex; the side ribs branch off alternately, and run in parallel straight lines to the margin.

The pollen-bearing *flowers* are distinct from the fruit-producing *flowers*, but they appear on the same tree. They grow out at the junction of the young leaf-stalks with the new shoots. The pollen-bearing flowers are crowded together into rounded bunches, which form small clusters, hanging freely by long slender stalks. The work of these flower bunches is to produce the fine yellow dust, or pollen, by which fertilisation is achieved. This pollen is scattered abroad by the wind, and so conveyed to the fruit-producing flowers. Their work accomplished, these bunches drop off and for a time litter the ground beneath. The fruit-producing flowers are enclosed in a green sheath having the appearance of a larger bud with short bristles attached. This grows higher up the shoot, and stands erect on a shorter stalk. When it has reached a certain stage of maturity, its two contained flowers receive and retain some of the wind-blown pollen from the myriads of pollen-bearing flower clusters. Then commences, and continues, the vital process by which eventually the mature fruit is produced. Nearly all our large trees, as we shall see, depend thus upon the wind's agency for the conveyance of the pollen from the pollen-bearing to the fruit-producing flowers.

RESTING BUD OF BEECH ENLARGED, SHOWING "SCAR" OF PREVIOUS YEAR'S LEAF.

The *fruit*, when ripe, is contained in a hard bristly capsule. This capsule splits open crosswise, its points bend backwards, and two three-sided nuts of a deep chestnut colour are exposed. Some of the empty capsules often remain on the tree for a considerable time.*

The only tree at all likely to be mistaken for the Beech is the Hornbeam. Points of difference will be indicated in the account of that tree.

THE OAK

The Oak has a rounded, spreading crown. Its general character is that of sturdy endurance and strength. Estimating its age by centuries of years, in maturity it stretches out below great boughs, horizontally, in defiance of gravity, basing its semi-circular crown with almost a straight line drawn parallel to the ground. The radius of that semi-circle may be a hundred feet and more. Its supporting stem, with expanding base, is built, massive and strong, to endure alike downward pressure of solid weight and side strain from force of tempest. Smeaton was well advised in taking the stem of the Oak as his model in designing the Eddystone Lighthouse tower, against which beating wind and bombarding wave should deliver vain assault.

In *winter* the great branches stand out twisted and gnarled, zigzagging in a way peculiar to and wholly characteristic of the Oak, multiplying elbows, knotting

* Only the external appearance of the flowers and fruits is indicated in these notes. For illustration of these, and a clear account of their structural details and meaning, the reader is referred to "Trees and their Life Histories," by Percy Groom. Illustrated from photographs by Henry Irving. Cassell & Co.

BLUEBELLS IN AN OAK WOOD.
From the Water-Colour Drawing by Mrs. Rawnsley.

these to hardness, never flinching nor failing of their purpose from their place of junction with the main stem to their clustered twigs at the extremities.

Spring opens out till most other trees are approaching full leafhood; but the Oak, with masterly reserve, gives no sign, save by the spreading of a ruddy glow over all its surface with the brightening of its multitudinous bud-clusters. Only when the season is well assured will a closer observation show that the deepening ruddiness of the whole has come of the first thrusting forth of new twigs and tiny leaves; a ruddiness which turns to green and gold as the tasselled catkins of the pollen-bearing flowers enlarge and droop amongst the increasing foliage.

By *midsummer* the tree is in full leaf. The withered pollen-bearing catkins, having done their work, litter the ground. The leaves, growing in rosettes and clusters, are bright green; they gradually darken in tint. Then, in the advanced summer, a new process begins. Many buds that did not open earlier now start into activity, expand, and break into leaf, so that, scattered over all the broad expanse of darkened green, are the ruddy tints and fresh brightness of young and growing leaf rosettes.

In *autumn* the fruits are plainly manifest, changing to ripe brownness in their green cups. The greenery of the Oak still persists, after most other trees have assumed their autumn tints and some have lost their leaves; the Oak, as it were, winning reward for spring's reserve by longer maintenance of summer's crown. Finally, the green changes to russet brown, the dried leaves for the most part retaining their position till late gales clear the twigs. But on young trees the dead leaves often stay till the new spring opens.

THE COMMON OAK IN WINTER.

The *trunk* is, as described above, columnar as a lighthouse tower, built for endurance, thicker at the base, and thickening again where division begins and the great lower limbs project. The *bark* is thick and deeply furrowed, in age becoming knotted and gnarled. It is light grey in colour, often rendered

still lighter by thick growth of silvery lichen. The *twigs* are comparatively short and stout, usually brownish. The *resting buds* are spirally arranged, becoming crowded and clustered at the tips of the twigs. They are thick-set, and stand, on projecting bases, well out from the twig.

TRUNK AND BARK OF OAK.

They are brown in colour, showing numerous protecting scales. The *scar*, where the previous leaf was attached, is somewhat shield-shape, having three sets of clustered traces where the leaf-tubes have been severed.

The *leaves* are oval in general outline, narrowing towards the base; but the general outline is deeply indented, making six to eight well-marked, rounded divisions. The midrib passes direct to the apex; the side ribs branch alternately and pass to the farthest away curves of the divided margin of the leaf. The stalks of the leaves, if any, are very short.

The pollen-bearing and the fruit-producing *flowers* grow on the same tree, but are distinct. The pollen-bearing flowers begin to emerge before the leaves, but as they expand the leaves also appear. Presently they hang down as clusters of catkins, 2 to 3 inches in length, like strings with unevenly-threaded golden beads. Later, and higher up on the young growing twig, at the junction of leaves and twig, appear the small stiff catkins of fruit-producing flowers. These are in shape like short erect spikes, having on them from four to six projections of pin-head size, which are the flowers. The pollen is carried from the pollen-bearing flowers to the fruit-producing flowers by the wind's agency.

TWIG AND RESTING BUDS OF OAK.

The well known *fruit* of the Oak is the oval-shaped acorn in its embossed cup, attached, two or more, to a considerable stalk, the outgrowth of the short erect spike which carried the fruit-producing flowers. When ripe the brown fruit falls, leaving the cup still attached to the twig.

There are *two varieties of the Common Oak*. The one, as described above, has stalked fruit-producing flowers and stalked fruits. It is named accordingly the "pedunculate," or stalked, Oak, and is the commonest of Oaks in the Midlands and South. Its leaves are practically stalkless. The other has stalkless fruit-producing flowers and stalkless fruits; these "sit," as it were, (sessile), close down upon the twigs, and so this is distinguished as the "Sessile" Oak. Its

LEAF SCAR OF OAK.

LEAVES OF TURKEY OAK, COMMON OAK, AND HOLM OAK.

leaves have fairly long stalks. This variety is more common in the west and north.

Some mention must be made here of the curious growths upon the Oak known as *galls*. These are the result of irritation caused by certain wasp-flies, which lay their eggs, accompanied by some irritant secretion, in various parts of the tree. The abnormal growth resulting becomes the shelter and feeding-place of the grubs till they are fully matured. One of these is the Oak "apple," so named from its likeness to that fruit, round and rosy, appearing with the early leaves. Another is the "currant" gall, attached to the drooping catkins of the pollen-bearing flowers, often several on a stalk and several stalks in a cluster, suggesting a bunch of currants. On the back of the leaves may be found others, one round and red like a cherry and so named "cherry" gall; others flat, rounded, brown or red, crowded together, and known as "spangles." Another gall, which is the outgrowth from an Oak bud, is itself like a curiously enlarged bud, the appearance of which is indicated by its usual designation, "artichoke" gall. Then there is the "marble" gall, hard, green at first, changing to brown, growing out of the substance of the twig, to which it still adheres after the fly has escaped.

FRUIT OF TURKEY OAK ONE YEAR OLD AND FULL GROWN.

There are, besides, many other kinds of Oak in cultivation. Two only of these need here be briefly described, and their details set forth in comparison with those of the Common Oak. They are the Turkey Oak and the Holm Oak, trees which, though rarer, are yet not unfrequently to be met with in parks or gardens.

THE TURKEY OAK

The Turkey Oak is also known as the "mossy-cupped" Oak, from its very distinctive fruit-cup. This tree has the general characteristics of the Common Oak, but its tendency is to grow more uniformly upright rather than spreading. Its branches are less twisted, its twigs longer. Its *bark* is darker in colour. Its *buds* are more

pointed, and have often, especially the terminal ones, attached to them thread-like appendages, the remains of certain leaf-like growths (stipules), from the previous season. Its leaf-scars are smaller, elliptical in shape, showing five to seven small leaf-traces, not grouped as with the common Oak, but extended in a curved line. Its *leaves* are stalked, as are those of the Sessile Oak. The leaf-margins are more deeply and sharply divided, often cut, as it were, down almost to the midrib, with the appearance of having been snipped away. Its *flowers* are similar to those of the Common Oak, but the pollen-bearing catkins are longer and more conspicuous. Its *fruit*, which scarcely grows at all during the first season, but remains as a tufted bud till the following spring, must be looked for then on the wood of the previous year. In the new summer it grows its "mossy" cup, which, sitting firmly on the twig, has the appearance of a doll's pin-cushion. Later, the point of the enclosed fruit emerges out of the centre of the cushion, grows out to a full-sized acorn, ripens to brownness, and falls.

TURKEY OAK IN SUMMER.

THE HOLM OAK

The Holm or Holly Oak is a smaller tree and evergreen, rounded, somewhat bush-like in appearance. Its *leaves* are thick and tough, dark green above, lighter beneath, oval in outline, often toothed, and shaped more or less like those of the Holly. They are spirally arranged on the twigs, and remain attached during two seasons, falling in the spring time. *Flowers* and *fruits* are much like those of the Common Oak, except that the pollen-bearing flowers are lighter in colour, and hang in shorter clusters; the fruits are relatively longer and sharply pointed, and so fully enclosed within the tightly-fitting cups that little more than their tips emerge.

HENRY IRVING.

THE GARDEN, TERRINGTON HALL, YORK.

THE DELIGHTS OF THE GARDEN

By H. H. THOMAS

"FLOWERS," says Ruskin, one of the greatest writers on the beautiful in Nature, "seem intended for the solace of humanity. Children love them; quiet, tender, contented, ordinary people love them as they grow; luxurious and disorderly people rejoice in them gathered. They are the cottager's treasure; and in the crowded town, mark, as with a little broken fragment of rainbow, the windows of the workers in whose hearts rests the covenant of peace." Here is a tribute to that real love for flowers and gardens that lies somewhere in the hearts of all of us. Deep, deep and downtrodden though it may be by heavy toil in crowded cities, buried beneath years of weary struggle in sunless tenements, it yet lives and ever and anon bursts forth in a glory that gains an added radiance from the unnatural surroundings that encompass it. The depth and vigour of its ramifications are betokened now and again by an occasional bursting into bloom amid strange and sad environment, never more pathetic than when the red-coated geranium and creeping jenny light up the window-sills in courts and alleys upon which the sun scarce ever shines. Was that inborn love for flowers ever more pathetically and more wonderfully shown than by the artisan in the Midlands, who, as recounted by Dean Hole, removed the very coverlet from his bed to protect his favourite plants from frost?

No branch of Nature Study has a finer

or more ennobling influence than that of flowers and gardens. Innate in every baby mind, a love for these needs only a fostering care to bud and blow and bear fruit that shall bring joy to the mind, and gladden the heart, through hours and days of worldly trouble. It is essential for the happiness of the individual, for the good of the race, that we should keep as close in touch with Nature as circumstances will allow; never was it so important as in these days of frenzied stress and storm, when the struggle for supreme positions, and alas! even for the wherewithal to live, is keener than ever before. It is good to turn for occasional moments from the bustle and hurry of life in towns and cities and contemplate the wonders of the world of Nature. It is good, even though to the warped and crooked mind it brings no earnest, heartfelt joy, touches no responsive chord, for it can hardly fail to bring home to one the fallibility of human agency, the unreality, the swift passing of man's handiwork. While, also, it must compel an appreciation of the unfathomable mystery that enwraps the simplest of Nature's problems. Who, for instance, can watch a seed come to life, slowly yet unerringly grow to flowerhood, ripen and fade, and not marvel at the secret of its progress, or cogitate upon the power that guides its growth safely to a predestined end?

Wordsworth, who sang so sweetly of the beauties of Nature among which he loved to dream, felt the subtle, the enthralling fascination that attaches to the life-history of the tiniest plant or flower. It is he who writes:

"To me, the meanest flower that blows can give
Thoughts that do often lie too deep for tears."

Shakespeare, whose wide knowledge was only equalled by the skill and charm with which he outlined his thoughts, often wrote of the deep delights of time spent among the flowers and woodland trees, far, far from the madding, crowded haunts of man:

"And this our life, exempt from public haunt,
Finds tongues in trees, books in the running brooks,
Sermons in stones, and good in everything."

And how inexpressibly great is the variety in the world of leaves and flowers. "To the attentive eye," says Emerson, "each moment of the year has its own beauty; and in the same field it beholds every hour a picture that was never seen before, and shall never be seen again."

A love for the flowers of the field, which may be accounted among the rudiments of Nature Study, is a certain pathway to the possession of a garden. From seeing and getting to know the plants of field and furrow, of hill and dale, of ditch and hollow, comes the desire to portray, if upon ever so small a canvas, some of the gorgeous pictures that Nature paints with generous brush. Nature mixes her colours with no niggardly hand—did the landscape gardener's art ever rival the fair beauty of a field in Poppyland or an autumn-tinted woodland hill, majestic tapestry, fresh woven from Nature's loom? We can but follow humbly in the steps of Nature's inimitable ways, remembering, after all, that the art we seek to pursue "itself is Nature."

Gardening is an art of which there are many phases. Everyone who practises its teaching pictures his own ideal garden, and in its capacity to please its creator it vindicates its right to be considered. It is in the varied ideals to which its practice gives rise, that gardening justifies Lord Bacon's dictum that "A garden is the purest of human pleasures; it is the greatest refreshment to the spirits of man." In his attempt to reach the ideal set up, the gardener finds real delight, and, paradoxical though it may seem, in its impossibility of attainment lies an equally potent source of pleasure.

True gardening, gardening for the real love of the thing, may be described as an attempt to attain the unattainable. There is no perfect garden, and so it is but human and, being human, natural that we should continually strive after its fashioning. In our striving we may find a charm equalled only by the delight that throngs in upon us when, as we imagine, we have achieved our purpose, the making of an ideal garden—ideal, that is, to our own individual and limited horizon.

During a talk on gardens and gardening with one who, it is admitted, has come as near to the making of a perfect garden as anyone may hope to do, the question was

asked, "Where, can you tell me, is there a beautiful garden?" The question seemed simple at the time, and I readily named several that are on the tip of everybody's tongue. But my friend would have none of them held up as a beautiful garden. Probably he was right if in this case we allow the literal meaning of

Photograph by F. Mason Good, Winchfield.

STRATHFIELDSAYE RECTORY GARDEN.

beautiful—full of beauty—and license ourselves to consider that a garden full of beauty must be a perfect garden. But does not this remark from one of the masters of the craft emphasise the futility of attempting to raise a standard whereby the Garden Beautiful may be judged? He would seem a bold man who would criticise the garden craft of Paxton, of Ingram, of Wildsmith, yet it would be equally bold to assert that the cottage garden (designed with care and planted with pleasured skill by its humble owner) were not beautiful. To him it is perfect, and to the master minds of Paxton and others the gardens of their own fashioning could not have been more, and might well have been less. The rose-coloured spectacles of enchantment are essential to the full enjoyment of one's own garden.

The association of gardening and good fellowship is proverbial; it offers a common meeting ground for high and low, for rich and poor. Round about the platform of roses and hardy flowers, rock plants and water plants, the learned great become as little children, to be instructed by those versed in the ways of the craft. And what depth of charm centres in the smallest plant is only discovered when one inquires into its perverse and hidden ways. How self-willed are some of the tiniest plants! Provide conditions in which they delight, and they reward you with bright leaves and brilliant blossom. Deprived of the luxuries upon which they have come to look as their right, how sulky they are! and how offended! Even the most robust of border flowers have their likes and dislikes; if, as becomes

A SUCCESSFUL SUBURBAN EFFORT AT A WINDOW GARDEN.

the giants of their race, they disdain to pout and show annoyance in ways excused to fragile plants, there is no comparison between their good behaviour and their best.

The realisation of the impossibility of finality in garden knowledge is forced upon one at every turn. One learns much only to find there is more to learn. Beware of the gardener who tells you that he knows his plants. Be sure that sooner or later his cocksuredness will lead him deep into pitfalls. Did one live to the age of Methuselah there would still be lessons to learn in the world of leaves and flowers. There is no finality here; there is no last page, no final leaf to turn. The greatest lesson to be learnt in its vast wonder tome is that of deep humility.

To search into the ways of garden flowers gives keen delight, yet their superficial beauty gives, perhaps, the greatest store of charm to many people. The Snowdrop piercing the frozen ground (what strength, what marvellous power in its tiny shoot!), Daffodils shimmering gently in the faintest breeze that blows, Tulips painting the ground with gladsome colours, and so on through the pageant of gaudy summer blossom, soft-toned autumn flower and winter's scanty bloom—each and all in their turn appeal irresistibly and with deep fascination even to the untutored mind. Can it be said with truth that they are the most fortunate who are content to drink only of the surface joys of gardening?

Lord Rosebery has said of gardens, "I am not sure that this is not one of the cases in which the ignorant have almost the best of it. I admit that when I walk with an expert through a garden I feel an ignorance, a humiliation which is almost abysmal. But I recollect, after all, that I may be the happier of the two. The expert knows all the weaknesses and the shortcomings in his garden. On the other hand the ignoramus walks blandly along enjoying without cavil the simple beauty of the flowers, enjoying what Lord Bacon has so finely called their breath, enjoying all their perfume and all the variety which a garden can give without question and without afterthought."

Yet to praise the picture is not to know of the days and weeks of patient labour that have gone to the mixing of the colours; none but those who have worked towards its completion realise that the chief joy comes not when the work is done but rather in the doing.

Gardens are like faces; there are no two alike in the wide, wide world. Even the uncountable gardens in the suburbs, similar in size, aspect, and in other particulars, have a certain individuality, each reflecting, to some extent, the character of its designer. As the human face is an index of the mind that works beneath the mask of flesh and blood,

so the garden is often an indication of the temperament of its maker. One might almost judge a man by his garden. A generous, benevolent disposition would show itself in the planting of broad, effective masses; ribbon borders and flower beds of geometrical design would appeal to those of methodical turn of mind; an indiscriminate dotting of similar plants in various positions might be expected to show a love of fine display, but a lack of knowledge and method in making the most of opportunities. One might suggest other analogies with the certainty that, more often than not, they would be in accordance with the facts.

A most satisfactory reflection is that for centuries gardening has been a joy and perfect relaxation to the hard-worked and harassed, and especially, perhaps, to the literary man. One of the saddest figures in the whole history of English literature is that of Alexander Pope. Deformed and crippled from birth, denied many pleasures common to the majority of men, the life of Pope demands much sympathy, in spite of the bitter and vengeful spirit that animates much of his writing. How excellent it is to know that Pope, the genius, the cleverest man of letters of his generation, found solace in the simple delights of gardening in his home at Twickenham.

"This garden," says Horace Walpole, "was a little bit of ground of five acres enclosed by three lanes. Pope had twisted and twirled and rhymed and harmonised this till it appeared two or three sweet little lawns, opening and opening beyond one another, and the whole surrounded with impenetrable woods."

Apparently Pope preferred the informal to the formal garden, which he thus satirises in his description of Timon's villa:

"His gardens next your admiration call,
On every side you look, behold the wall,
No pleasing intricacies intervene,
No artful wildness to perplex the scene;
Grove nods at grove, each alley has a brother,
And half the platform just reflects the other."

"The picture of Pope amusing himself with his plantations, directing old John Searle, his gardener, and conversing with

HONEYSUCKLE AND CRIMSON RAMBLERS.
A "back-yard" Garden, Wollaston, Northants.

the friends whom he compliments so gracefully, is," wrote the late Sir Leslie Stephen, "perhaps the pleasantest in his history." Can we, then, be too grateful to gardens and gardening that brought joy into the crooked life of one so great as Alexander Pope?

landmark on the path of life, where every flower is hallowed by associations that seem to stand out in greater relief, clearer and more precious, as hours are lost in days, and weeks pass swiftly into years.

The only other garden that can com-

A COUNTRY HOUSE GARDEN: "WIGGANTHORPE," YORKS.

After all, a garden fails in its purpose unless within its friendly shade we find an abiding sense of exquisite peace, a solace that soothes, a balm for worldly care. And where can these be found in greater degree than in a garden, providing it is a garden that one loves? To know the real charm of a garden one must have grown up with it or have made it. A garden around which are entwined the thoughts of childhood and early youth—seeming to us, over the bridge of years, to be the happiest time of life, a time when the world of actuality was enveloped in a golden halo of eager anticipation—this is, perhaps, the most perfect garden one could wish to have. But how very few of us can hope to live and die in that old-world garden, where every bush and every tree is a

pare in any way with this is the garden made with one's own hands, and tended with fostering care, in which one may bring again to life the dreams of youth, and re-people with memory-faces the dimmed and distant past.

The making of a garden in which the spirit of peace may find a rest, implies, at first, much care and self-denial. It implies much tender nurturing of fragile slips, of wayward seeds, of gentle reproving of overbearing plants that would usurp the ground that is not theirs by right. There is no delight in gardening comparable to that found in plants that one has grown, tended from babyhood and brought healthily to prime. The associations of a garden cluster round the life-histories of its plants and flowers —the Moss-Rose from the border of some

close friend; the home-saved seed; the old Clove Pink, rescued from oblivion by timely thought; a Fern from cool, sequestered lane that lingers in some untroubled corner of the mind, to which, sometimes, one turns, and not in vain, for soothing memories—all these and many more should be found in the garden that one loves.

How difficult it is to make a garden that shall be more than a mere collection of plants—a garden haunted by the spirit of other days, peopled by ghosts of welcome memory, lit by stray shafts of mellowed light from gladsome times bygone; a garden that shall have *soul* as well as body! In what melodious words does the Poet Laureate, in "The Garden that I Love," picture the choice of gardens, gardens for young, gardens for old. I quote only the first four lines of each stanza:

"Had I a garden, it should lie
All smiling to the sun,
And after bird and butterfly
Children should romp and run.

"Had I a garden, alleys green
Should lead where none would guess,
Save lovers, to exchange, unseen,
Shy whisper and caress.

"Had I a garden, claustral yews
Should shut out railing wind,
That poets might on sadness muse
With a majestic mind.

"Had I a garden, it should grow
Shelter where feeble feet
Might loiter long or wander slow
And deem decadence sweet."

To make a garden that shall closely approach one's ideal it is best to let the flowers grow much as they list, to let wild Nature have her way, even on well-tilled ground. A little of rose-gardens, of wild gardens and water gardens, of rock gardens a little, and a little of flower gardens, if carefully blended, would blossom into a pleasaunce full of charm if the tending were with care and not precision, with love yet not with affectation, with pride yet not with proudness, with tenderness not lacking in firmness. Before attempting to blend the one with the other, it is well to know something of the ways of plants, their likes and dislikes, their good points and bad, so that one's knowledge of the individual flowers may stand the final and supreme test of their association in a garden where the plants shall not only grow but live, and in living give of the pure joy that is within them.

H. H. THOMAS.

HOW TO KNOW THE INSECTS

By JOHN J. WARD

Author of "Some Nature Biographies," "Peeps into Nature's Ways," etc.
Illustrated from Original Photographs by the Author

THE AWAKENING OF SPRING

HOW to discover and distinguish the insects is always a puzzling matter to the amateur naturalist. Insect species are very numerous; indeed, so numerous that they are said to outnumber those of all other land animals put together. The would-be student of insect life has, therefore, an immense field in which to work; and yet there are people who, while most desirous to understand the wonders and workings of the insect world, complain that when out on their country rambles they rarely are able to find anything of interest. To such the practical entomologist appears to be endowed with some supernatural gift; and when he suddenly removes a dead bird lying in the path and collects some pretty black and orange-striped beetles from beneath it, he becomes a complete mystery-man, for, "How did he know that those beetles were under that bird?" The explanation is very simple. The entomologist differs from others only in that he has learned to use his eyes a little more; or, in other words, he has cultivated his observing faculties a stage farther than have his neighbours.

The would-be entomologist has, perhaps, been reading some detailed life-story of an insect; his interest has been aroused, and out he goes into the country full of enthusiasm and determination to investigate things on his own account. His enthusiasm, however, presently begins to wane, and it is very likely he returns home a disappointed and exhausted investigator. During his ramble, for some reason, insects seem to have been particularly scarce. His failure cannot be attributed to want of energy, for he started out expressly for the purpose of finding insects, but, although he has searched high and low, his journey has been almost fruitless; in fact, it might have been entirely so had he not almost stepped upon a pretty caterpillar, which he may be said, therefore, to have discovered quite accidentally.

The intentions of the amateur entomologist are most commendable, but his methods are wrong; indeed, his troubles arise largely from the fact that he has no methods. He expects too much, and wants to accomplish in an hour or two all that the practical entomologist has, by careful and incessant observation, laboured for years to learn. To know the insects, knowledge is required, and, like other knowledge, there is no royal road to it. But let not this dishearten those who would study insect life; the warning is given here only to prevent discouragement as the result of a first disappointment. When the amateur learns that he must proceed slowly by short steps at a time, it is surprising how soon his experience grows, for the minor observations of to-day lead to greater and more interesting discoveries on the morrow.

I propose, therefore, to take some imaginary rambles with my readers, and to endeavour to help them to see insect life in its various phases, dealing more particularly with those common insects which are most likely to be met with by the amateur naturalist during a country ramble. I may, however, occasionally introduce an insect of rare or special interest.

We start on a delightful morning in early May. A lovely blue sky bends overhead, and the cold winds that have

characterised the last few days have given place to an almost balmy atmosphere, while every living thing around us seems to be overflowing with the joyousness of life. Numerous birds are chirping incessantly, the cuckoo and lark are making more decided music, and so, too, are the young lambs. We have but to note the delicate green that now enlivens trees and hedgerows, the bright golden yellow of the dandelion and the lesser celandine, to realise what a marvellous thing is sunlight. All this re-awaking of life and loveliness about us comes in response to the invigorating influence of the energy stored in sunshine. Above and below us life is bubbling forth on every hand.

CATERPILLARS OF THE DRINKER MOTH FEEDING ON COARSE GRASSES.

Here it is in one form on these coarse blades of grass beneath the hedgerow; so coarse are they that, if roughly handled, they will cut the fingers. The tissues of the grass contain quantities of the mineral substance silica, or quartz, and it is this material that inflicts the wound; and yet here we find feeding on these tough, flinty blades some fine grey and yellow-streaked caterpillars, with tufts of white and brown hairs along the sides of their bodies. This conspicuous larva is readily distinguished by its colours, when it is seen feeding on coarse grasses; it is one of the commonest of caterpillars in spring. It eventually becomes the Drinker Moth (*Odonestis potatoria*), familiar about July. These caterpillars are usually hatched from their eggs late in July and feed until October;

then they hibernate in sheltered corners through the winter. About April the warm

FEMALE ORANGE-TIP BUTTERFLY ON FLOWERS OF LADY'S SMOCK.

sunshine tempts them from their winter quarters, and so we find them nearly full-grown in May.

Few insects have sufficiently good digestive organs to relish the coarse silicious deposits in the tissues of these strong grasses on which the Drinker Moth caterpillars feed; by cultivating this curious taste, therefore, they have found for themselves a feeding ground which they can enjoy comfortably without being crowded by hungry competitors. It is said of this larva that it will put its mouth to a dewdrop and suck it up; hence the name "drinker." I cannot verify this from personal observation, but it certainly is found most often in damp situations, and, although it is unusual for caterpillars to drink, it would not surprise me that these larvæ should do so, seeing how indigestible their food material must be.

By the ditch, over which the Drinker Moth larvæ are feeding, extends a piece of moist land on which the pale mauve blossoms of the lady's smock are conspicuous. While picking our way amidst the watery ground, what is, presumably, a small White Cabbage Butterfly appears to view. It alights among the lady's smock flowers and is seen to be moving about beneath them; it never attempts to reach the opened blooms where one would naturally expect to see it searching for the nectar. But it is not nectar this butterfly is seeking, it is engaged on quite other business.

FOUR ORANGE-TIP BUTTERFLIES.
Showing how they become inconspicuous amongst the umbels of green and white flowers.

When near enough to see the butterfly, the first thing that strikes us is that a great change has come over it. It is no longer a White Cabbage Butterfly, but has become a mottled green and white. This is due to the fact that when the insect was flying we saw the upper side of its wings, which were almost white; now that it has closed its wings over its back we see the under side of the lower wings. It will be well to notice, also, that the butterfly has its feelers clubbed at their ends. Now, clubbed antennæ, or feelers, and wings closed over the back are the two characteristic features of a butterfly. The antennæ of moths always terminate in a point, and these insects usually rest with the upper sides of their

AN EGG OF THE ORANGE-TIP BUTTERFLY ATTACHED TO A FLOWER STALK.
Magnified 25 diameters.

wings exposed. Now that we know how to distinguish Moths from Butterflies, we may continue our observations.

The mottled green lower wings make it clear that we are not dealing with a White Cabbage Butterfly, for the under side of the wings of that insect are white or pale yellow. We have here, then, the female of the Orange-Tip Butterfly (*Anthocharis cardamines*). The butterfly is called "orange-tip" because of the large blotch of bright orange colour on the tips of the forewings of the male insect. In the lower illustration on page 46 is shown a male butterfly, the dark tips of the wings representing the orange colour.

Our butterfly has been occupied for several minutes amongst the flowers of the lady's smock, or cuckoo-flowers as they are sometimes called, and now a sudden burst of sunlight has induced it to take to its wings again. Before leaving these flowers, however, let us glance at the work on which the butterfly was employed. Examining the little stalks of the individual flowers by means of a pocket lens (the amateur entomologist should always carry a pocket magnifier, one that can be purchased for a shilling will serve all his needs), we find that the butterfly has placed here and there one of her tiny and beautiful eggs. In the illustration on this page one of these eggs is shown as it appears when magnified. Thus we have the beginning of some Orange-Tip Butterflies for next spring.

Later on, if we carefully examine the lady's smocks when their flowers have changed into long, narrow seed pods, we shall probably find feeding upon them some green caterpillars, very similar in size and appearance to the pods themselves, and these caterpillars represent the next stage of the Orange-Tip Butterfly. It is interesting to note that when the caterpillar has consumed the seed pod from the tip downwards, it rests on the upper part of the stalk, and, being similar in colour and form to the pod, it often escapes the vigilant eyes of its enemies by thus mimicking its surroundings.

In connection with mimicry, the Orange-Tip Butterflies themselves may be noticed as evening approaches. I have previously pointed out the mottled green and white colours of the under side of their lower wings. Now these butterflies frequently rest upon flowers of the wild parsley tribe,

CATERPILLARS OF ORANGE-TIP BUTTERFLIES FEEDING ON SEED PODS OF LADY'S SMOCK.
Showing how the caterpillars resemble the pods.

characterised by their umbels of little green and white flowers. If you will glance at the illustration on page 46 you will notice that, while the butterfly in the centre with open wings is quite conspicuous, the one on the right with partly closed wings

"WOOLLY BEAR" CATERPILLARS. WHICH EVENTUALLY BECOME TIGER MOTHS.

appears like only half a butterfly, for its lower green and white wings harmonise so well with the flowers that they become inconspicuous. On the extreme left of the illustration is another butterfly with wings still more closed, and this; it will be observed, is still less conspicuous. Between that butterfly and the central one is still another, with wings completely closed, and this has become almost invisible. In this way the Orange-Tip Butterfly evades the eyes of its foes. Even between its caterpillar and butterfly stage, when it becomes a chrysalis, it also mimics its surroundings, as I hope to show you in due season.

Here by this warm wall facing the sun is another familiar insect. Everybody knows the "woolly bear" caterpillar so frequently seen crawling across the garden path, and always appearing to be in a hurry. In the garden the "woolly bear" is very mischievous, but in the country it is generally found feeding on the common white flowering nettle, or dead-nettle, where it does no harm. It has an artful way of rolling itself into a ball when it is touched, and dropping down amongst the herbage, where it generally escapes, since its long, flexible hairs give way so promptly to the touch and leave its body so readily, that it becomes difficult to pick it up. Although this caterpillar is so familiar, it is, nevertheless, not always associated with another equally familiar insect. I refer to the common Tiger Moth (*Arctia caia*) which appears about July. For it is this beautiful insect that the "woolly bear" eventually becomes.

Another of England's commonest and most beautiful insects is the Small Tortoise-shell Butterfly (*Vanessa urticæ*). This butterfly is frequently, but wrongly, called

the "garden tiger," for, as I have shown above, the "garden tiger" is a moth

A PAIR OF THE COMMON TIGER MOTHS.
The upper one is the male.

and not a butterfly (note its pointed feelers). The Tiger Moth and Tortoise-shell Butterfly are very different in habit. The moth is a night-flying insect, while the butterfly is a creature of the sunlight. The "woolly bear" hibernates through the winter, like the larva of the Drinker Moth, but the beautiful Tortoise-shell Butterfly, frail though it may seem, is hardy enough to live through the rains and frosts of winter as a perfect butterfly, hiding away in the roofs of barns and out-houses, and similar places; and this is why it is one of the first butterflies to make its appearance in the spring; indeed, a warm sunny day in winter will often tempt it to stretch its wings. One individual specimen that came under my notice took up its winter quarters in the roof area of a country church, and on several Sunday mornings during service took exercise, much to the amusement of the congregation. After it had appeared several times, it was suggested to me by a worthy member of the congregation that it must be the music that it liked, as it appeared to fly only on Sunday mornings. Personally I rather doubt the accuracy of that suggestion. It was much more likely that the butterfly appreciated the increased temperature of the building during service hours—even though the music may have been of the highest quality.

It is clear then that the various insects spend the winter very differently. Later, we shall find that other insects winter in the chrysalis stage, and still others as tiny eggs. In the illustration on page 50 are shown two other caterpillars that have lived through the winter. You may at first have a little difficulty in distinguishing the caterpillars, although they are conspicuous enough as they stand on the bare elder twig. These caterpillars are so stick-like that, although they are over two inches in length, they are quite unnoticeable. They are holding on only by their tail claspers, and form an angle with the branch just as do the twigs. The mimicry of the twig here is perfect; for hours at a time these caterpillars will maintain these quaint stick-like attitudes,

SMALL TORTOISE-SHELL BUTTERFLY.

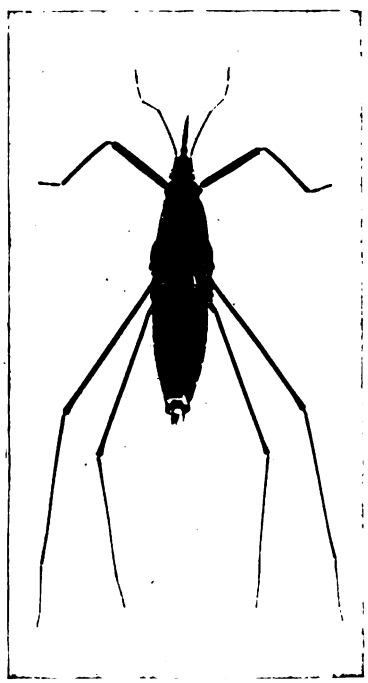
and so completely deceive their enemies. Eventually each of these fraudulent twigs

TWO STICK-LIKE CATERPILLARS RESTING ON AN ELDER TWIG.
Natural size.

becomes a Swallow-tail Moth (*Uropteryx sambucata*).

Some curious spider-like animals with long legs are darting and gliding across the surface of a clear pond, here, in a very marvellous manner. They flash over the water much more actively than most insects move over the dry land, and yet they never seem to get submerged. If a small fly should fall, or is blown, into the pond, you will see them rush upon it; for it is on such small game that they prey. When seen on the water they appear to have eight legs, but this is because their large antennæ, or feelers, look like a pair of legs. A glance at the illustration will show that they have only six legs. This, it should be remembered, is a characteristic feature of insects. In their larval stages insects often appear to have more than six legs, as in the case of caterpillars. Only the three first pairs, however, are true legs; the claspers disappear as the insect reaches its perfect form. These Pond-Skaters have only six legs throughout their development, and do not pass through distinct caterpillar and chrysalis phases. The young differ from the old apparently only in size; although they really possess other differences with which we need not now concern ourselves. Their marvellous powers of movement on the surface film of the water are due to the fact that their legs and bodies are clothed with minute hairs which form a pile that rejects the water. They spend the winter in the adult form, under banks and amongst leaves and stones. In the spring they deposit their eggs amongst the water plants.

Finally, we may glance at two daffodil yellow butterflies sailing along with



A POND-SKATER.
(Gerris najas).
Magnified two diameters.

merry flight. This time it is the Brimstone Butterfly (*Gonopteryx rhamni*), which, like the Tortoise-shell Butterfly,

spends the winter in the winged state. That the butterflies are a pair there is no doubt; indeed, you have only to glance at them, as they fly, to see which is the wooer and which is the wooed. One is distinctly daffodil yellow, the other is paler, being more of a primrose shade. The latter is the female, and in the illustration she is seen on the upper side of the leaf, while her daffodil suitor rests on the lower side; for even after all his bold manœuvres in the sunlight chase of his lady-love, he is not brave with his proposal; perhaps he fears lest his suit may be rejected!

BRIMSTONE BUTTERFLIES LOVE-MAKING.

JOHN J. WARD.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.

Author of "Wee Tim'rous Beasties," etc.

THE LONG-TAILED FIELD MOUSE

With Photographs by the Author

THE Long-tailed Field Mouse is one of the commonest, if not *the* commonest, wild animal in this country. I have already described the progress of the infant of this species until the time when it has found its legs—about a fortnight after its birth. For another fortnight it remains an ill-balanced, leggy, bulbous little beast, with a huge head and blobbery mouth. After this it gradually fills out, and in about four months' time has, in all but colour, attained to perfect Mousehood. I have not been able to determine accurately how long it is before the brindle sepia of the adolescent is exchanged for the tawny rufous of the adult; but I have little doubt that the colour change varies somewhat with the season, and that a Field Mouse born early in the year will be a "red" Mouse earlier than one born late. There are changes, also, which seem to depend on the locality and food supply. There is a general tendency in Field Mice to develop a yellow patch on the chest, and the name "Yellow-necked Mouse" has been applied to large, full-blooded individuals in which this patch, spreading backwards and crossways, forms a handsome collar and pendant. I am not sure that there are sufficient grounds for classing the Yellow-necked Mouse as a distinct sub-species, and I am equally diffident as to the standing of other varieties which have been assigned to various islands round the coast. There can be no question, however, as to the interest of these records, and it is curious to find that the St. Kilda and Hebridean Field Mice are *larger* than the ordinary British and Irish types.

A close examination of a wild animal will usually give some idea as to its habits, and this is markedly the case with the Long-tailed Field Mouse. His eyes show that he is nocturnal, his ears show that he is alert, his limbs show that he is athletic.

AN IMMATURE LONG-TAILED FIELD MOUSE.

The eyes of the Long-tailed Field Mouse are remarkably prominent and remarkably large. There is no visible iris in a mouse's eye. All that one sees externally is the fully distended pupil. This in a full-grown Field Mouse measures about four millimetres across, and this measurement is equal to the length of the longest finger in the mouse's hand. A similar proportion in man would make the width of his distended pupil nearly four inches. We can only speculate as to what effect a pupil (with corresponding eye) of this size would have on human vision; but I think we may safely speculate to this extent: that the sensation of light conveyed to the brain would be enormously increased, and that, consequently, our discrimination of light and shade (not necessarily of detail) in darkness or semi-darkness would be much more sensitive.

There is little doubt, moreover, that the eyes of Field Mice have a remarkable range of vision. The normal human eyes embrace a very narrow angle with distinctness, perhaps not more than five degrees. This is compensated for by the fact that they move simultaneously in their sockets, and by this simultaneous movement, coupled with a movement of the head, command a large field. The eyes of Mice are permanently fixed, but their vision, instead of being parallel, is widely divergent. Field Mice have a constant squint of about 140 degrees. Apart from the protrusion of their eyes, this squint means an enormous field of view. Dr. Lindsay Johnson, whose researches on the eyes of animals are extremely valuable and interesting, informs me that the hare and squirrel can, by a combination of both their eyes, see through an angle of 420 degrees—that is to say that, in addition to their ability to see round themselves in a complete circle, the vision of either eye overlaps that of the other to the extent of some 50 degrees in front and 10 degrees behind. I do not think that the Field Mouse is much behind them. His attitude when frightened is instructive. If one observes a Field Mouse who is not frightened from a point somewhat above and behind him, one finds that his eyes are hidden by his ears. If, however, he is frightened, he depresses the nape of his neck and flattens his ears in such a way that their tips converge. Under these conditions, his eyes protrude rather more than usual, and are plainly visible from the same view point. To lose sight of them one has to bring one's own eyes very nearly to their level, when they are hidden by the mouse's back. It is obvious that an arrangement whereby a mouse, when flattened to the earth, can look behind him as well as above and on all sides must be of great advantage to the race. The same tendency to depress the neck may be observed in the Meadow Mice and Water Rat, and I have no doubt that it is usual among the Mouse family.

As may be seen from the illustrations, the Field Mouse's ear is large in proportion to his head—about half the length of it, in fact. At first sight it appears to be

naked, but careful examination will show that it is not so. The outer portion, which is purplish and opaque, is thickly covered with short silky fur, the inner portion, which is pink and transparent, is almost hairless. The ear is situated closer to the eye than is the case with the House Mouse, and this, coupled with a pronounced arching of the nose, gives him a resolute, almost fierce, expression. I am inclined to think that Field Mice, and other small animals, hear a somewhat different range of sounds to human beings. A shrill squeak with the lips will mightily startle a mouse, while a dull, heavy sound, of far greater volume to our ears, will hardly interest him. No doubt a quick ear for squeaks and rustlings has proved profitable to the race. The Field Mouse has an excellent control over his ears, and can prick and depress them at will; moreover, as might be expected from their size, they are extremely sensitive. Before a human being has fairly grasped the fact that a sound has occurred, a Field Mouse will be off and under cover.

A glance at a Field Mouse's limbs stamps him at once as an athlete, and a closer examination shows that both hands and feet are excellently adapted for grasping as well as movement. His feet have the usual eleven pads, one at each toe tip, one between the bases of each toe, and two farther back. Each toe has, in addition, six or seven well-marked furrows across it with corresponding ridges. It is probable that these furrows and ridges are largely concerned with the sense of touch, but they must certainly help him to a secure foothold. Pads and furrows appear also on his hands, though the fact that his thumb is rudimentary naturally decreases their number. The tendons of his toes and fingers are extraordinarily elastic, and, as a result of this, every joint on his hands and feet is in the popular sense "double"—even "treble" sometimes, for some of his finger and toe joints admit of a considerable bend sideways. Each finger and toe is armed with a sharp claw, and in a battle with his own kind these claws are used offensively.

It is somewhat remarkable that, for all his martial air, the Field Mouse is a peaceful little beast. A long list of Mouse fights furnishes me with only one record of an encounter between two of his species—and these were captives.

At large and undismayed, the Field Mouse is worth watching. Sometimes one meets him casually, but from such meetings little can be learnt.

Mouse sights man first, and treats him as a danger.

Yet this is not invariable. Mouse sometimes is engrossed in his own business—his toilet, for example; and sometimes he is half-way up a hedge. He is not so much a climber as a balancer. For choice he runs on gently-sloping branches, his grip clenched tight, his tail stretched taut behind him. He eats most buds and berries in the hedgerow, and it is a pretty sight to watch him stretch on end to reach a dangling fruit. Here his roughed palms and soles must serve him well. There are good records of his amassing a store of food in some old bird's nest (half a pint of hips and haws, says one observer, reckoning by the uneaten husks), and sleeping in the midst of it.

Most small beasts clamber on occasion.

LONG-TAILED FIELD MOUSE.
1. Showing position of ears when frightened.
2. Showing normal position of ears.

I have a note of a Shrew Mouse in a bird's nest some five feet from the ground,

many notes of Field Mice and Red-backed Meadow Mice aloft, but none as yet of Short-tailed Meadow Mice. A good tail seems essential for the balance.

One must do more, however, than trust to chance to study Field Mice worthily. The best plan is to mark their holes. I do not think the hedgerow Mouse is normal. Field Mice are sociable, gregarious folk, and live for choice in small communities a foot or so beneath the surface. The site of some long-fallen tree (whose roots remain) is ideal burrowing ground, and here one may often count on finding Field Mice, Red-backed Meadow Mice, and Shrew Mice together.

The entrances are common ground, but what goes on below one has no means of knowing. There may be disagreements. The association of the three species, however, is so usual that one is driven to suppose that either these disagreements are temporary, or that the room for them is larger than would appear from the outside.

To anyone gifted with good sight the observation of Field Mice, once their hole has been discovered, is not particularly difficult. Even those whose sight is defective can manage comfortably enough with a glass, though they are somewhat handicapped by the need of adjusting it. The golden rule is to remain still, and to do this you must secure an easy position before the mouse appears. Provided you keep still, you may do anything in reason. You may smoke, you may bring your knitting (if you knit quietly), you may bring a friend (if you converse in even tones). So surely as Mouse is at home, and the weather is fit for Mouse to be abroad, so surely will Mouse appear. He has his own set times, and these you must discover. The twilight suits him generally, so does a change to better weather, calm after storm, sunshine after rain, for, though nocturnal, he must have fresh air, and wet or windy nights mean close confinement.

Watch as you may, you seldom see his exit. The human eye, unlike the cat's, grows weary with long waiting. Mind-pictures float in front of it. Yet, if you have kept still, this matters little. A leaf flirts two feet from the hole, and instantly you wake again. You stare intently; all seems as before: the leaf, the hole, the nut you placed beside the hole. Mouse is underneath the leaf, *and watching you.* This is the crucial moment. One wonders what is passing in that brain of his. The sense of the prime danger, man? or just the sense of danger? Man moves with crackling tread and swings his arms. You are quite still and motionless. Therefore you are a tree-trunk. There is a scent of man about, but man's scent clings to everything.

I think this is his reasoning; I gauge it from his actions.

His nose points from the leaf's near side. You feel it sniffing. You feel his whiskers shiver. Then come his eyes, and then he stands forth openly. He stares at you, and you stare back. A long, queer, breathless, spellbound pause, and he prepares to clean himself.

A false start that time; he must look again. Another pause. But now he seems more satisfied. He sits back on his haunches. His wee hands jerk towards his face and, quivering down the length of it, are moistened by his tongue. Thence to his nose and eyes and ears in fluttery, light caresses. Thence to his tongue once more. He twists about and nibbles at his sides, his hands now two unravelling combs which grip the fur and press it to his mouth. He drags a hind-leg forward and, grasping it between his hands, licks it to spotless whiteness. While it still gleams, he plies it on his ear. He backs an inch past his own tail, grips the free end, and polishes the rings.

And all the while, his eyes have never left you.

Keep still the harder; there is more to see.

He starts off running. He runs in dots and dashes—queer little clockwork lightning runs; queer little checks and pauses. He seems to scent the nut. He pokes his nose in likely places. His tail points stiff. He swings this way and that. You try to sight the nut yourself—and fail. Then only does it dawn on you that there are two mice out; one has the nut already. Seeing the pair of them together, you realise that one—the one you have been watching—is small and slim and brown. The other is a full-grown mouse, red-backed, perhaps a Yellow-neck.

Red Mouse is busy with the nut. He sits back slightly, bends his head, and gnaws the shell at random. You cannot call him skilful. Nuts are unstable things and should be lifted. But Red Mouse never lifts his nut. He fumbles with it on the ground, and this means less control. Though teeth and hands work to a common end, the ground deceives his sense of touch and steals the nut away from him. A Dormouse should instruct him.

Brown Mouse is well aware of this, yet creeps up unconcernedly. He really does not care for nuts. Red Mouse wheels sharply right about, and sets a furry back at him. Brown Mouse, quite unabashed, steals past his flank and fronts him. Once more Red Mouse swings round. Once more Brown Mouse steals past. Brown Mouse would have the nut between them. Red Mouse would have Brown Mouse behind him. So they go semi-circling.

Red Mouse gnaws fiercely all the time, but Brown Mouse tires the sooner. He sits behind Red Mouse and thinks. Where boldness fails, guile may succeed.

He squirms beneath Red Mouse's tail. Red Mouse tilts up obligingly (Mice love to sit in heaps), but, as he tilts, his hind-legs leave the ground. Still he keeps gnawing; out steal two small aggressive hands and Brown Mouse has the nut.

Red Mouse is plainly mystified. He hears faint rasps and scratchings. They sound from underneath him. Where has that Brown Mouse got to? Where is that nut? But presently he topples to one side and Brown Mouse starts off running. Red Mouse pursues, the nut is dropped, and Red Mouse comes once more into his own.

The pair of them have almost reached your feet. But for the failing light, you might see more. You slowly stretch yourself and rise. You saw the last three leaps of them—leaps a foot long, two hundred to the minute, for frightened Field Mice bound like kangaroos.

This leaping power is notable. In France it gives a pretty name to them—*Rats sauterelles*, Grasshopper Mice.

The Field Mouse can manage a standing jump of two feet upwards, and I have known one leap boldly downwards from a first-floor window, land on a flower-bed, and proceed unhurt.

DOUGLAS ENGLISH.

HOW TO KNOW THE WILD FLOWERS

By the REV. H. PUREFOY FITZGERALD, F.L.S.

With Photographs by HENRY IRVING

THE FLOWERS OF THE WAYSIDE—II

THE COLTSFOOT

THE Coltsfoot (*Tussilago farfara*) is a representative of a large family of plants, the *Compositæ*. These herbs, in the great struggle for existence, have found it best to amalgamate and co-operate. Each flower really consists of many florets collected together into a single head; the calyx of these Compound flowers is called an involucre. Examine the yellow flower of the Coltsfoot and you will see that the florets are of two kinds, the outer ones, forming the ray, are more or less strap-shaped, and are all female; that is to say, they have pistils, but no stamens. The inner florets, composing the disc, are smaller and tubular in shape, and produce honey and pollen. The Coltsfoot is very common on waste ground, and rejoices especially in a moist clay soil, its presence generally indicating stiff, poor ground. The flowers appear before the leaves, about the end of February or the beginning of March, each stem rising straight from the ground and bearing a single head of florets; when the flowers wither the head

becomes pendent (as may be seen in the photograph), probably to protect the young seed from the wet; as the fruit ripens, the head once more becomes erect, and the dandelion-like seed is blown away by the wind. The leaves appear afterwards and are large and curiously angular in shape; beneath, they are covered with a thick, woolly down. Pliny mentions that the dried leaves and roots were smoked through reeds, the smoke being swallowed as a remedy for a cough—whence the name *Tussilago* (*tussis*, a cough).

THE DAISY

The Daisy (*Bellis perennis*) is another representative of the Compound flowers; it is to be found blossoming more or less throughout the year. This plant is too well known to need any introduction; by some writers the name is said to come from the "day's eye," from its habit of opening at sunrise and closing at sunset. In Scotland it is frequently the "bairnwort," from its being especially beloved by children; "gowan" is also another name by which it is known in the north.

The chief advantages in the arrangement of the Composite flowers are: firstly, that the flowers in being grouped together are more conspicuous than they otherwise would be; secondly, that insects are more readily attracted to them because of the facility afforded of collecting the honey; and thirdly, that the visits of insects are more likely to ensure the transference of pollen from the many small male flowers to the stigmas of the other florets, and so secure fertilisation.

COLTSFOOT.

THE MALLOW

Three different kinds of Mallows are commonly to be met with by the roadside, flowering throughout the summer. The most striking of these is the Musk Mallow (*Malva moschata*), the flowers being of a bright rose-colour, crowded together at the top of the stems and branches. The five wedge-shaped petals will be seen to be jagged at the ends, and there are three small leaves, called bracts, below the five-toothed sepals; in the bud the petals are curiously twisted. The lower leaves are more or less round, whilst those on the stem are deeply divided. In the Common Mallow (*M. sylvestris*) the flowers are of a reddish purple colour, and are produced in clusters springing

MUSK MALLOW.

ROUGH CHERVIL.

from the base of the leaves; the dark veins on the petals are very conspicuous. The Dwarf Mallow (*M. rotundifolia*) is a much smaller plant, with bluish flowers; it may be distinguished from the other two by its more trailing habit. The flat, green fruits of the Mallows are sought after by children, who call them "cheeses."

THE DAISY.

THE CHERVIL

The Chervils introduce a large family, the members of which are somewhat puzzling and difficult to distinguish from each other. All the *Umbelliferæ* have their flowers arranged on short stems, which spring from the same point, like the iron stays of an umbrella. The Rough Chervil (*Chaerophyllum temulum*) is a common wayside plant, with pretty, divided foliage; the outer petals are larger than the rest, and this will serve as a distinguishing feature. The stem is slightly thickened at the joints, and is curiously blotched with purple. The arrangement of this kind of inflorescence must be of considerable advantage, since any visiting insect generally spends some little time on each head, gathering honey from the many flowers, and transferring pollen from one to the other as it goes.

The Rough Chervil grows about three feet high, and is to be found by waysides and in the hedges, flowering during June and July.

H. PUREFOY FITZGERALD.

HOW TO KNOW THE BIRDS

By the REV. MAURICE C. H. BIRD, M.A., M.B.O.U.

With Photographs by
RICHARD AND CHERRY KEARTON

THE THRUSHES

IN the locality where I am writing almost everybody knows the Song Thrush from the Missel Thrush, though the former is generally called a Mavish and the latter a Fulfer; but although we have a regular visitation of Redwings and Fieldfares, wintering with us more or less abundantly year by year, their differences are practically undiscovered by many people, who jumble the two species together as "French Mavishes," whilst some confound the Fieldfare with the Missel Thrush and the Redwing with the Song Thrush. In point of size the Missel Thrush is the largest of the four; on the ground or in flight it at once strikes one as being a more strongly built and more lumpy bird than the Fieldfare, which is, perhaps, an inch shorter. The Redwing is the smallest of the four — about 8 inches in length. Not that measurements alone can be trusted for the identification of any bird, as, for example, in December, 1904, I handled a Song Thrush in full feather which only extended to 6¼ inches.

In *plumage*, Missel Thrush, Mavish, and Redwing are much alike, the distinguishing marks being as follows. The Missel Thrush alone has a white patch at the base of the inner web of the two outer tail-feathers on either side, these being conspicuous in flight. It may also be known from both the Song Thrush and

MISSEL THRUSH AND NEST.

Redwing by its axillary or armpit feathers, which are white; whilst in the Song Thrush they are buffish yellow, and in the

BLACKBIRD'S NEST AND EGGS.

Redwing, as its name implies, they are a decided chestnut-red. Redwing and Song Thrush may also be known apart, in that the former has a well-defined whitish stripe over the eye, extending from the beak nearly to the nape. There are dark spots on the throat and breast of all four species, but they are largest and most conspicuous in the Missel Thrush, their surrounding ground colouring being also lighter than in either of the other three birds. The entire upper plumage of the Fieldfare is strikingly different from the uniform sombre olive-brown of Mavish, Redwing, or Missel Thrush, although it has the white armpit of the latter. His head and rump are slate-grey; wings and tail are conspicuously dark; throat rich brown, streaked rather than spotted with black; and the belly is white; the latter being clearly seen in flight. In some seasons Fieldfares stay with us as late as the first week in May, by which time the beaks of the males have become brightly suffused with yellow. Neither the Fieldfare nor Redwing remains to breed or sing in England, and so their call or alarm notes alone can assist us in distinguishing them by ear, the noisy "chack-chack" of the former being more frequently heard than the softer and subdued "se-you" of the latter. Both of these birds are more or less gregarious, feeding, flying, and roosting in small parties. It is a habit of the wily Fieldfares, whilst resting on tree or fence, for all members of the assembly to face one way, ready to take wing at once should their sentinel give the alarm note. Curiously enough, both these winter visitors from more northern climes succumb to frost and snow sooner than Song or Missel Thrush, being probably less omnivorous and more chary

SONG THRUSH'S NEST AND EGGS.

of approaching the habitations of man, even when hunger presses.

The song of Mavish and Missel Thrush may sometimes be difficult of identification.

Both are very early songsters; but, as its common name proclaims, the former possesses the more musical, if not the louder notes. He is also the most constant singer throughout the year. Reference to my note-books remind me that since 1875 I have chronicled his tuning up in every one of the twelve months—though not the same bird, or in the same year, of course; for seasons differ, and during the moulting time all song birds are silent.

Missel Thrushes cease singing after their last broods are reared, when they leave their nesting sites and become more or less gregarious, pairing and challenging one another again in song with the new year. The nickname of "Stormcock" has been won by the loud persistence of the Missel Thrush in defying wind and rain, whilst pouring forth from the top-most spray of tallest tree its loud, short, oft-repeated strains. Only the mild days throughout the winter tempt the Mavish into sweeter song—sent forth from lowlier perch: song immortalised by Tennyson, and reduced to words by many lesser bards before and since: song which varies greatly, not only according to the listener's sense of sound, but also according to the singer's surroundings. For the Thrush is a good mimic, and can vocabulate the typical notes of very distant relatives, one—presumably the same bird—here copying correctly for several seasons the Marshland Redshank.

MISSEL THRUSH AND NEST.

FEMALE SONG THRUSH AT NEST WITH YOUNG.

In flight, beyond the conspicuous dif-

ference observable in plumage between the Fieldfare and the Missel Thrush, Redwing, and Song Thrush, and the fact that

YOUNG MISSEL THRUSHES.

the two former are generally seen in companies and the latter two alone, the altitude at which the Fieldfare and Redwing fly is usually greater than that indulged in by the Song and Missel Thrush. Its strong and undulating method of moving through the air from place to place is distinctive of the bold "Stormcock."

In nesting habits, Song and Missel Thrush are so far similar, in that both commence to build early in the year. Both make large and conspicuous nests frequently in the vicinity of houses; but there the resemblance stops, for though the outside materials used in either case may be somewhat similar, the Song Thrush lines her lighter nest with a practically air-tight plaster of mud or cowdung and rotten wood, and thereupon deposits her black-dotted sky-blue eggs. The Missel Thrush may utilise some such daubing sparingly ere her cradle is half constructed, but she proceeds to finish off with an abundance of fine dry—sometimes only half-dead—grass, raising a more solid structure with not so deep a cup as the Mavish delights to brood in. The necessity of these differences—bar the mud-lining, perhaps—may be found in that the Missel Thrush frequently builds in the large crotches of tall and leafless trees, whilst the Song Thrush chooses generally less exposed situations, amongst more slender branches, which demand a lighter and deeper nest.

The better concealment afforded by the site usually selected by the latter bird—frequently amongst evergreens—precludes the necessity of any such attempt at protective coloration, of egg-shell or nest exterior, as is indulged in by the Missel Thrush, whose eggs are of a much more subdued shade both as to ground colour and markings; and she also resorts to the artifice of weaving in and around her nest pieces of grey-hued lichen, which is parasitic upon the surrounding branches. There are exceptions to every rule, and so it is not surprising sometimes to find the nest of this otherwise wary bird, not

YOUNG SONG THRUSHES.

only placed within a few feet of the ground, but also advertised in its whereabouts to every passer-by in consequence of its external adornment of a piece of white paper, calico, lace, or coloured dress material. Only three or four years ago I insured the safety of a family by removing one such impediment from a nest built within five feet of the ground and within double the distance of our carriage drive. One last point of distinction between the nestlings of Song and Missel Thrush: the down, or filo plumes, of the latter are retained for a longer time, and are lighter in colour.

Though the young of the Blackbird are distinctly spotted, and in their first plumage of somewhat lighter ground colour than the adult female, they are not likely, in either sex, or at any age, to be mistaken for those of any other British bird, unless it be the Ring Ouzel, a much rarer bird as to its general distribution. It breeds only in mountainous or moorland districts, and occurs but sparingly elsewhere as a passing spring and autumn migrant. At the latter season it is especially partial to elderberries and, as I once noticed, to black currants. As to plumage differences, the possession of a white, crescent-shaped gorget, or throat-band, will generally serve to distinguish Ring Ouzel from Blackbird. The difference in size between the two species is too small to be serviceable; but, at fairly close quarters, the greyish-white edging to the feathering of the former gives it a distinctively dull appearance compared with the glossy jet-black jacket of the adult male Blackbird, and it also lacks the set-off of the proverbial "orange tawny bill" of the ubiquitous Blackbird, the champion, to my mind, of all British songsters. The barred, or spotted, plumage of the young of both species shows, as the similarity of size and shape suggests, their relationship to the Thrushes.

BLACKBIRDS AT NEST.

In the two lower pictures the male bird is shown feeding the nestlings.

With regard to habits, the regularly practised flirting of the tail immediately after alighting—which, when the evening light begins to fail, serves to distinguish the Blackbird (a very late feeder) from the other Thrushes—will not assist us in recognising him from the Ring Ouzel, which also indulges in the same conceit. As to habitat,

as a general rule the one frequents cultivated, and the other unenclosed, land; whilst the Dipper, or Water Ouzel—also a bird of restricted range, and only occurring regularly in the neighbourhood of mountain torrents or rapidly-running streams—may just be mentioned because its name suggests a possible mistake being made between it and the Ring Ouzel. Moreover, it also is a black bird, and has in both sexes a white throatlash similar to the Ring Ouzel; but its aquatic proclivities and stumpy wren-like tail should be sufficient to prevent any likelihood of mistaken identity. The nest of the Dipper is also Wren-like. Its eggs are pure white; its song in no wise resembles that of its upland relative; its whole economy, in fact, is entirely different from that of the Ring Ouzel.

MALE BLACKBIRD.

M. C. H. Bird.

HOW TO KNOW THE CLOUDS

By WILLIAM J. S. LOCKYER, M.A., Ph.D., F.R.A.S.

With Photographs by the Author

II

COMING now to the clouds which in the classification fall in the intermediate layer, the highest of these is the *cirro-cumulus*. These can easily be identified, as they are composed of small globular masses or white flakes without shadows, or with very light shadows, and they arrange themselves in groups, and very often in lines. Sometimes they appear like waves on the surface of water, and occasionally two distinct systems are observed, the regular striæ apparently crossing each other. This type of cloud is perhaps better known as "mackerel sky," as the flecks have a thin scaly appearance, like unto scales of certain fish.

CIRRO-CUMULUS CLOUDS.
Photographed at South Kensington, July 13, 1907, at 10.50 a.m.

The example of cirro-cumulus shown on page 65 is from a photograph taken at South Kensington on July 13th, 1907, at 10.50 a.m. Here we see the globular masses covering the north-eastern part of the sky, and with some tendency to form into lines.

The next type of cloud in order of descent is the *alto-cumulus*, moderately large globular masses, white or greyish, partially shaded, arranged in groups or lines as the cirro-cumulus, and often so closely packed together that their edges become confused. A good instance of this type is shown in the next two illustrations, which illustrate a most interesting transformation of cloud form, both specimens of which come under the alto-cumulus heading. The photographs were taken at South Kensington on May 10th, 1907, with an interval of forty-two minutes between them, and the camera was pointed in practically the same direction—namely, north-east—for both exposures.

In the photograph on this page it will be seen that the clouds at this time—

ALTO-CUMULUS CLOUDS.
Photographed at South Kensington, May 10, 1907, at 11.33 a.m.

11.33 a.m.—formed themselves in parallel lines, the globular masses in each line being practically welded together. This condition of things was the same all over the sky in that quarter of the heavens. At 12.15 the whole of this series of lines had broken up into separate masses, as will be observed in the succeeding illustration. It will be noticed that the lines are still fairly maintained, only their direction is not quite the same as that indicated in the previous illustration.

The form of cloud which must be described next—namely, the *alto-stratus*—is not here illustrated, as not only is it uninteresting from the photographic point of view, but its description defines it

ALTO-CUMULUS CLOUDS.
Photograph taken forty-two minutes after that on p. 66.

STRATO-CUMULUS CLOUDS.
Photographed at Tunbridge Wells, Dec. 25, 1906. at 11 a.m.

NIMBUS CLOUD.
Photographed at Tunbridge Wells, May 18, 1907, at 11.33 a.m.

better than any photograph would do. It consists simply of a thick sheet of a grey or bluish colour, and in the neighbourhood of the sun or moon shows a brilliant patch. Unlike cirro-stratus, it does not give rise to halos, but sometimes causes coronæ (bright rings, closely surrounding the sun or moon). Measurements have shown that this type of cloud is only half as high as the cirro-stratus type.

Passing now to the lower clouds, we come to the *strato-cumulus*, a cloud which is too irregular to be called stratus and not sufficiently lumpy to be called a cumulus. This type signifies large, globular masses or rolls of dark cloud, which frequently cover the whole sky, especially in winter, and sometimes presents a wavy appearance. The masses are not dense, and between them blue sky is often seen. In fact, we have here a type of cloud which is very much like the alto-cumulus, only situated at a much lower level, and consequently the cloud masses appear on a rather larger scale. The lower illustration on page 67 will serve to illustrate this type. The original photograph was taken at Tunbridge Wells, on December 25th, 1906, at 11 o'clock. The brightest part of the picture in the lower portion indicates the neighbourhood of the winter sun, which was obscured most of the morning by this and by alto-cumulus form of cloud.

We now come to the *nimbus*, or rain cloud. This type is composed of a thick layer of dark clouds without any definite shape, and with ragged edges, from which rain or snow generally falls. Its approach is usually accompanied by a great diminution in daylight, and in consequence is not an easy object for the camera. Underneath the layer of nimbus there are, as a rule, small loose clouds which may have become detached from the main

cloud, and which float at a great speed at a lower level. This has been termed *fracto-nimbus*, or broken nimbus, and is the equivalent to the word "scud" commonly used by sailors.

The illustration on page 68 shows a nimbus giving a copious rainfall, some distance away from the camera, after it had just passed over Tunbridge Wells. This photograph was taken on May 18th, 1907, at 11.33 a.m. The rain, it will be seen, was coming down in bucketfuls, and it is interesting to note the different angles at which it is falling under different parts of the cloud. This was, no doubt, due to the varying air currents which so commonly accompany such rain-storms.

WILLIAM J. S. LOCKYER.

HOW TO KNOW THE INSECTS

By JOHN J. WARD

Author of "Some Nature Biographies," "Peeps into Nature's Ways," etc.

Illustrated from Original Photographs by the Author

SPRING'S TRANSFORMATIONS

MANY of those insects which become conspicuous on almost the first day that provides bright sunshine and a mild temperature, and so herald spring, disappear from view towards the end of May. The amateur Nature student often fails to observe how suddenly and completely they vanish, because so many new insects are continually appearing to occupy his attention. Later on, however, he realises that a certain butterfly, moth, or caterpillar which was previously very abundant, is no longer to be found, and it becomes obvious to him that insects have their seasons; he also learns that some of these seasons are very brief.

There is, for example, the Brimstone Butterfly, which I introduced in my first paper. My earliest recorded day (for the Midland counties) when that species was really flying is March 16th. On that occasion I saw four butterflies together. It is true that a single example may be seen on any day during winter, for, as I have previously stated, these butterflies live through the winter. Until the end of May, in the Southern and Midland counties, the butterflies are familiar objects on every sunny day; their brimstone and pale yellow wings are continually seen fluttering along by the hedgerows and skirting the woods. Then, almost suddenly, they cease to appear, and we forget all about them until some day early in July; Brimstone Butterflies are then in evidence again, and the amateur entomologist is sorely puzzled to account for their disappearance during the prior seven or eight weeks.

Such incidents are of frequent occurrence in the life-histories of many species, and those who desire to know the insects should always endeavour to discover what happens during the interval when they are not visible. A little time spent in such investigations will do more towards the making of a Nature student than whole weeks spent with net in hand capturing butterflies, and other insects, and carefully naming them. The latter work may eventually produce a well-arranged insect cabinet, and its owner may become a veritable human entomological catalogue, able to label an insect at a glance, and to spell out its scientific name with marvellous ease, but, nevertheless, it does nothing towards revealing the curious and interesting habits of insects; it does not explain how marvel-

lously their life schemes are harmonised with the seasons and the particular food and conditions they will need; indeed, the dry-as-dust collector knows scarcely anything of these things, his chief knowledge consisting of dates and districts when and where the insects may be found.

Let me, therefore, warn the would-be Nature student not to be too anxious to collect. He will be able to do this, if he so desires, later on, when he has learnt something of the ways and habits of the insects, and much more efficiently then, since his observations will have guided him and given him method in his work. How then must the amateur begin? For answer let us consider the case of the Brimstone Butterfly.

CATERPILLARS OF BRIMSTONE BUTTERFLY.

In early May we observed that the butterflies were love-making, and after the mating attention is given to family matters, which, in the case of insects, usually means merely the depositing of eggs in suitable situations for the independent development of the offspring. When digging in the garden early in the year we may come upon an instance of exceptional care for the young of insects. I refer to the common Earwig, which maternally sits upon her batch of forty or fifty eggs until they are hatched, and even thereafter guards and protects her young. The Brimstone Butterfly, however, rarely lives to see her offspring, although her eggs hatch into caterpillars in some eight or nine days after they are laid, and even if she should live it is improbable that she would ever recognise them. All interest in her offspring ceases as soon as she has deposited the last of her eggs; by that time, too, her strength is so completely exhausted that, it may be, she has but a few hours to live.

Since this butterfly deposits her eggs only on the two British species of buckthorn shrubs, they are easy to find. They are usually placed on the veins of the under sides of the leaves. I need not introduce a picture of the egg, because it is almost of the same form as that of the Orange-Tip Butterfly shown in my previous article (p. 47), being only a little more elongated. So when the pale yellow butterfly is seen fluttering about amongst the leaves of buckthorn shrubs, there is the first observation to record.

Eight or nine days after her visit some little caterpillars emerge from the eggs which she has so diligently placed amongst the leaves. About four weeks later you may go and shake them from the trees, for they are then full-grown. In the illustration on this page the caterpillars are shown feeding; they are coloured pale green with a white stripe along each side of their bodies. This, then, is the reason why early in June Brimstone Butterflies are not to be seen; only an occasional belated example, or a very early one of the next generation,

is then to be met with. The parent butterflies that lived through the winter have ceased to exist, and those butterflies that will suddenly appear about the beginning of July, are, as we have seen, feeding on the buckthorn leaves. Later on, we shall doubtless discover the connecting links between these hungry caterpillars and the yellow winged butterflies.

COCOON OF DRINKER MOTH CATERPILLAR.

At the beginning of the month, too, we glanced at the caterpillars of the Drinker Moth. Where are they now? Well, the cuckoo, that calls from the distance, could probably account for many of their number, for that bird is one of the caterpillar's most persistent enemies. A search amongst the coarse grasses on which these caterpillars fed will probably reveal some spindle-shaped objects attached to their stems (as shown in the photograph on this page), and safely wrapped in these are the fortunate larvæ that escaped the cuckoo.

By this time, however, the caterpillar has most probably changed into a chrysalis, lying within the strong cocoon it has constructed from self-spun silk, interwoven with tufts of the white and brown hairs that decorated its body. So it will rest for some four or five weeks—when we must look for it in its new guise.

Other quaint bundles may be seen suspended by silken threads from elder twigs. These are very differently constructed, they are composed of small pieces of leaves fastened together by means of silken threads. If we pull the bits of leaves apart, in the centre of each of these cocoons we shall find a dark-coloured chrysalis together with a shrunken caterpillar skin. The skin is shrunken so much that even if it be straightened out it will probably give but little clue as to what its late owner was like. It happens, though, that I saw the cocoons shown in the illustration, when in the process of construction, so that I am able to say just how they came to be, and the story is simply this: Two most curious and interesting caterpillars held to the branches very firmly by their tail claspers while they stretched out to reach the leaves, from which they bit pieces. Each caterpillar first gathered two pieces and suspended them to the

COCOONS SUSPENDED FROM ELDER TWIGS.

A CATERPILLAR PREPARING FOR ITS METAMORPHOSIS.

branch by silken cords that it spun for the purpose. Then, working independently, each larva joined its two bits of leaves together by means of other threads, the bits of leaves then forming a kind of ring. After this foundation was laid matters were comparatively simple, the caterpillars continually adding other bits of leaves until they had sufficient to cover their bodies. Eventually they let go their hold with their tail claspers and dropped into their leafy hammocks, which now hung suspended on the silken cords that held the two first-gathered bits of leaves to the branches. After about forty-eight hours from the commencement of the work, the caterpillars had sealed up the inside and disappeared from view, leaving things as shown in the illustration (p. 71). A peep into one of the cocoons a few days later revealed a pupa, or chrysalis; for the developing insect had changed its form simply by moulting its skin. And there the story ends, except that I have not yet stated what species of caterpillars these were. That will be quite unnecessary, however, as I have already introduced my readers to the two identical caterpillars that constructed these leafy cocoons. I refer to those two fraudulent individuals shown on page 50 of my previous article.

THE CHRYSALIS.

The various metamorphoses through which insects pass is certainly one of the most fascinating features of study in the lives of these little animals. In woods of the southern counties another curious transformation scene may be witnessed at this season. From beneath a branch, or leaf stalk, a curious spiny caterpillar may sometimes be found suspended by its tail, in the manner shown in the photograph on this page. If such a caterpillar is again noticed two or three days later it appears as in the next illustration. There, a chrysalis appears instead of a caterpillar. The caterpillar, it should be observed, is holding itself in a curved position which tightens up the skin at the back of its head. Eventually the strain causes the skin to burst at that part, after which the skin shrinks slowly towards the caterpillar's tail-end, attached to the stem; finally the old skin falls

LIME HAWK-MOTH.

DEVELOPMENT OF THE PALE TUSSOCK MOTH.

to the ground and leaves the chrysalis hanging. Thus we have an instance of a chrysalis being produced without a cocoon to protect it, for here we have a butterfly developing and not a moth. Some species of moth caterpillars, however, also become chrysalides without constructing cocoons, but these generally hide amongst fallen leaves, or are buried in the soil. The butterfly that appears from this chrysalis I hope to introduce in my next article.

In the illustration on page 72 we have an example of an insect that has completed its development. This is the Lime Hawk-Moth (*Smerinthus tiliæ*), which in early June will sometimes be found resting as shown in the photograph. It is a charming insect. Its rich, grey browns, contrasted with patches of bright olive green, together with its irregularly-cut wings, simulate its surroundings so well that amongst the leaves and branches its harmony with its environment is perfect; the eye may glance over it several times before it is realised that it is a large moth that is looked upon. Even in the photograph—although the insect is there shown right in the foreground backed by the bare branch—it does not force itself upon the eye as a moth. Much of this subtle effect is doubtless due to its irregular blotches of colour. It is interesting to note also, that the individual moths vary immensely, so that their enemies have little opportunity to accustom their eyes to its scheme of colour; and probably to them the moth is even much less conspicuous than it is to us.

When gazing on the lovely wings of the Lime Hawk-Moth as it rests, it seems scarcely credible that, only an hour before, the moth was buried a foot deep in the earth; yet such was the case. From September, throughout winter until June, it has been entombed, not as a moth, but as a chrysalis formed from the caterpillar that buried itself in the soil. Now it has crawled through the coarse earth to the surface, climbed the tree, and developed its wings. When it reached the branch it had no wings, at least nothing more than dumpy apologies for such. At the end of an hour, however, its organs of flight were fully developed. How they developed I will show by considering another example of a familiar moth; for all moths on leaving the chrysalis develop their wings in practically the same manner.

Look at the long-bodied, short-winged insect shown in the first illustration on page 73, and then see it again in the second photograph. In the latter the moth is seen commencing to extend its wings. Ten minutes later they appear as shown in the third photograph, having elongated more than twice the length shown in the first. In the fourth illustration they are shown some five minutes later when fully developed and drying. In my first article I pointed out that moths rest with the upper sides of their wings exposed. This moth, it will be noticed, is resting while showing the lower sides of its wings, for at present the wings are wet and therefore are not under muscular control. Later on they dry and become rigid, and then the moth suddenly reverses them into the positions they naturally assume when the moth is resting as shown in the final photograph. Both moths and butterflies select the under sides of branches and leaves on which to develop their wings, so that they can fall from their folds and hang in space while they dry and complete their development. Thus we have produced the common Pale Tussock Moth (*Dasychira pudibunda*). This moth, previous to the development of its wings, crawled from the ground amongst the dead leaves, leaving behind its cocoon constructed from the quaint tufts of hairs that clothed its body when a caterpillar and protected from view by lightly attached leaves. This cocoon the caterpillar had formed the previous autumn, and, in due course, it fell to the ground with the leaves at the time of their "fall."

From the foregoing examples it is clear that insect life does not begin in the spring and terminate as winter approaches. With a little knowledge of the habits of insects, the Nature student may study insect life at any time during the year. It is obvious, also, that a few life-histories completely investigated will lay the foundation of much future knowledge.

JOHN J. WARD.

HOW TO KNOW THE BIRDS

By the REV. MAURICE C. H. BIRD, M.A., M.B.O.U.

With Photographs by
RICHARD AND CHERRY KEARTON

THE WARBLERS

NEXT to the Thrushes we come to the Warblers, a large group of small and delicately shaped birds, most of which are migratory, although their flight is apparently feeble. As their name would lead us to expect, amongst them are to be found our most delicious songsters. Their life's work seems to be that of keeping in subjection the countless forms of small insect-life, which, if unrestrained, would destroy the vegetation of our fields and groves.

With the two exceptions of the ubiquitous Robin Redbreast and familiar Hedge Sparrow, all are shy and unobtrusive. The nickname of "Shuffle-wings" lends a ready aid to the identification of the latter, for it cannot be watched for many moments together without betraying its identity by restlessly attempting to open its wings, only as rapidly to close them again. It is no near relative to the House or Tree Sparrow — which belong to the hard, cone-shaped beaked birds— whereas all the Warblers have slender bills.

The word "sparrow" means "chirper," and so our homely drab-clad little "Shuffle-wings" gained its names of

HEDGE SPARROW ON HER NEST.

Hedge Sparrow, Hedge Accentor, or Hedge Chirper, from its habit of giving forth its subdued song conspicuously from wayside fences in early spring ere foliage gives concealment to it, its nest, or turquoise-tinted eggs.

As the House Sparrow "chirping on the wall foretells rain coming soon," so the Hedge Sparrow is also included in the list of avian weather prophets from its habit of frequently uttering its short and plaintive call-note "speek, speek" (hence the epithet "Hedge Spike") in damp weather. Its dark blue-grey throat is its only attempt at personal adornment. Though chiefly insectivorous, I find the Hedge Sparrow often takes toll of wheat when I am feeding my poultry with small corn, whereas when their diet is changed to maize, Blue Tits soon discover the difference, and carry off grains of the Indian corn, to pick out the soft base, and drop the remainder.

These last remarks may not seem to have much connection with bird identification, but it is always helpful to know what species we may expect to meet with at certain times and places, and how they are likely to behave whilst they are knowingly or unwittingly under our observation. Thus, when we are calling our domestic fowls to feed, the accustomed whistle or "cur chick" is likely to attract various small wild birds, especially in the winter time; in hard weather I have even had Rooks and Grey Crows thus wait upon me. House Sparrows are sure to put in an appearance, and perhaps

THE WHEATEAR.

STONECHAT'S NEST AND EGGS.

a few Tree Sparrows, a Chaffinch and a Greenfinch or two. Not one of the last three will ever venture to approach within some few yards of you, and the crafty House Sparrow is not nearly so daring as the bold Blue Tit, which will dash down from a neighbouring perch to seize and carry off a grain of corn from within a few feet of your toes; whilst the confiding little Hedge Sparrow, even less suspicious of harm than a Robin, will unconcernedly hop around at close quarters, so long as you stand perfectly still—an indispensable qualification for successful bird watching.

Wheatear, Whinchat, and Stonechat are sometimes confused; all three are migrants, though a few of the latter remain throughout the winter. The Wheatear, decidedly the largest of the three, is the most likely to be found on cultivated land, not that its name has any reference to agriculture, but is supposed to be derived from two Saxon words for its distinguishing mark, a white rump, which is very conspicuous in flight. It is a restless bird, ever on

WHINCHAT'S NEST AND EGGS.

MALE REDSTART.

the move, and when flitting from one bush, stone or clod to another, the white base of its tail and back are easily observable, showing up in bright contrast to the black flight feathers in the wing and at the end of the tail.

The Stonechat's tail is whole-coloured, dark brown, though there is a dash of white where tail and body unite; the Whinchat has the base of the tail feathers white, partly concealed from view in flight by the brown tail coverts. It has two white bars on the wing coverts, the Stonechat one, and the Wheatear none.

The whole upper plumage of the Wheatear is pale bluish grey, in the Whinchat it is brown tinged with rusty red, especially on throat and breast, and there is an almost white stripe over the eye. The Stonechat is more brightly and patchily clad, with black head and throat, chestnut-coloured breast, and the sides of the neck, as well as the wings, splashed with white.

The call note of all three is a somewhat similar "chack"—hence their family name of "Chats." All three are frequenters of the open country, the Wheatear delighting in sandy heaths and warrens, especially near the coast; the Whinchat, as its name implies, may be looked for where Whin or furze abounds, but it also occurs in heath and grassy districts; whilst the Stonechat is seldom found residing except where poor soil encourages furze to flourish.

A YOUNG REED WARBLER

Movements of the tail are characteristic of each of these restless birds. The Wheatear, more a bird of the ground than the other two, takes short runs, moving rapidly, stopping suddenly, and flirting its tail meanwhile. The Whinchat and Stonechat both love to perch on the topmost twig of any bush that they frequent, and both are equally fidgety, not merely in the twitching of their tails, but in moving from one coign of vantage to another, sometimes taking insects in the air after the manner of the Flycatcher.

All three are early breeders, especially the Stonechat, and the nests of both it and the Whinchat are very difficult to find because so generally well concealed and protected, either on or very near the ground, beneath the prickly gorse bushes. The Wheatear actually goes to ground for breeding purposes, selecting when possible the mouth of a disused rabbit's burrow for depositing its dull pale blue eggs, the shells of which are of rougher texture and less frequently tinged with indistinct patches of reddish brown towards the larger end, than is the case with the smaller and more elongated and slightly darker shaded eggs of Whin- and Stonechat.

The male Redstart might be mistaken for the male Stonechat, in that both are red and black and white, but the respective colours are differently placed, and the haunts and habits of the two birds are distinct. The Redstart's distinctive mark is hidden in its name—for "start" means tail, as the more expressive, but more local, designation "Firetail" brings out. The red tail is common to both sexes, and although the bird itself is no larger than the Stonechat, its tail is longer in proportion. It is a summer visitor and a frequenter of gardens and orchards, and though not common it is widely

distributed and by no means of shy disposition, returning year after year to nest in the same hole in wall or tree.

REED WARBLER'S NEST.

At Beccles Grammar School, in the early seventies, a pair bred for two successive seasons under the inside eaves of a long lean-to lobby through which fifty to sixty boys passed several times a day. Not only is the red tail sure to attract attention, but the white forehead of the male Redstart, prefaced by a black line, contrasts so strongly with the black face and throat, bluish grey head and back, and chestnut breast and rump, that forehead and tail at once distinguish it from all other British birds.

The names of Sedge and Reed Warbler help us somewhat to separate between the two Waterside Warblers, for although the former may be found in the vicinity of ditches, ponds or streams of small pretensions, the latter demands a reed-

bed of some extent, therefore the Sedge-bird is the commoner of the two, and is almost certain to be found wherever the

SEDGE WARBLER.

Reed-bird occurs. Both are little brown birds with rounded tails, but the Sedge Warbler has its upper plumage spotted with darker brown, and the buffish white line over the eye is much more conspicuous than in the Reed Warbler.

The nesting habits of the two species are quite distinct, for while the Sedge Warbler builds a comparatively clumsy nest low down amongst any kind of marsh undergrowth, and even in high and dry situations at some distance from the water—at Cambridge I once found one in a garden gooseberry bush—the more particular Reed Warbler weaves a beautiful deep-cupped cradle, suspended above the water by the aid of three or four reeds. I have now by me four nests, mown out by marsh cutters, in which seven, five, five, and nine reed-stems are thus utilised, and the lining is chiefly composed of the feathery bloom of the former year's reed. Both of these Marsh Chats are incessant singers, and although their notes are somewhat alike, and both can be roused into song by being disturbed after dark, the Reed-bird gives the better music, which is not so harsh nor does it contain so many notes borrowed from other birds as does the chatter of the bolder Sedge Warbler.

The Nightingale, fastidious in its habitat, but surely betraying its whereabouts by its proverbial notes, is far more often heard than seen, for although it does not rest by day, it is a great skulker, and delights in thick undergrowth,

NIGHTINGALE.

especially where oak is the prevailing timber. In fact I never remember having found a nest of this species of which dead oak leaves did not form a part of the outer covering. Perhaps the only bird for

WOOD WARBLER'S NEST AND YOUNG.

BLACKCAP'S NEST AND EGGS.

FEMALE BLACKCAP SITTING ON NEST FULL OF YOUNG.

which a Nightingale might be mistaken is a somewhat large Robin without a red breast and with a slightly elongated and ruddier tail than usual—the make and shape of the champion songsters of winter and summer being similar.

The Blackcap is inferior in song only to the Nightingale. Leave out the distinct and piteous wailings of the latter, and remember that they are chiefly heard during the time when all other birds are silent, whilst the Blackcap competes with the whole chorus of the grove, and we must confess that the Nightingale owes much to the bewitching solitude and twilight for exceeding popularity over the less melancholy voiced Blackcap.

The Garden Warbler, a specially good performer of the species, runs the Blackcap very close in point of melody, so that voice alone is no safe guide to identity. When once the respective songsters can be seen, however—and neither is so retiring as the Nightingale—the black hood of the male of the latter species, and the brown cap of the female, at once identifies them from the more sombre whole-coloured Garden Warbler.

There are yet two other small birds, somewhat similar to the last named, which also might be mistaken for one another, namely the Common and the Lesser Whitethroats. All these Warblers are between five and six inches in length, and the so-called Whitethroats are by no means conspicuous for the whiteness of their bibs, although sufficiently so to distinguish them from the Garden Warbler. The commoner bird of the two Whitethroats is really common everywhere, and in consequence rejoices in several local names; "Hay-jack," from its frail dead-grass cradle, being the most frequent, while "Nettle-creeper" declares its partiality for situations where such weeds luxuriate. It is a merry, cheerful bird, not much of a songster, but frequently uttering its excited and erratic warble as it mounts

WHITETHROAT ON NEST.

from the roadside fence to seize a passing insect. With the possible exception of a wild cock Blackbird in winter, no British bird can throw itself more suddenly over a hedge than the male Whitethroat.

The Lesser Whitethroat is more a bird of the shrubberies, and builds its similar nest at a greater altitude than its more frequent relative; its eggs are smaller in proportion, while the ground colour of them is nearly white instead of greenish white, and the markings are more blotchy and more nearly confined to a zone at the larger end. The only difference in plumage between the two species is that the smaller bird has a dark patch between the eye and the beak, and its back is bluish grey, whilst that of the other is reddish brown.

The Chiffchaff, Willow Warbler, and Wood Warbler, arranged in ascending scale of magnitude, are all three so similar in appearance—little yellowish-green birds—that it is practically impossible to draw any sufficient distinction between them to enable the novice to identify them apart in life. In song, however, they differ much. The Chiffchaff is about our earliest spring migrant, and his two monotonous notes soon betray not only his arrival but also his name. The Willow Wren, or Willow Warbler, is by no means dependent upon willows either for a living or a lodging, it being the most generally distributed of the three species. Its "weeping" song seems loud for so small a bird. The Wood Wren, or Wood Warbler, is the rarest of the three, and more confined to a wooded country. Although all three seek their food chiefly from arboreal insects, and frequent tall trees in their search, all build their dome-shaped nests either on or very near the ground. The Wood Wren alone declines the use of feathers in the lining. The eggs of each are much alike, and a practised eye alone can differentiate them apart from the nest.

M. C. H. BIRD.

CHIFFCHAFF AND NEST.

WILLOW WREN.

WILLOW WREN'S NEST

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.
Author of "Wee Tim'rous Beasties," etc.

THE HARVEST MOUSE

With Photographs by the Author

THE Field Mouse is a handsome, well-bred gallant, the Dormouse a soft, comfy, round-eyed ball; but, for the dainty grace of Dresden china, give me the Harvest Mouse.

It is an unkind fate which makes him, of all our Mice, the least likely to be casually encountered. Not that he is more nocturnal, for he loves the sunshine; not that he is inconspicuous, for he is white and orange; not that he is shy, for, like most small things, he is pushful. The secret may be summed up shortly: the Harvest Mouse is inaccessible.

THE HARVEST MOUSE SUPPORTED BY HIND FEET AND TAIL AFTER RUNNING UP A CORNSTALK.

Those who would see him often must either take up quarters in a corn-stack, or roam at large among the growing crops, both of which schemes are inconvenient.

Moreover, they must choose a likely county. The distribution of the Harvest Mouse (and of the Dormouse) is of curious interest. For the moment we must confine ourselves to the former. His breeding season is a short one—say mid-June to mid-September. My own records give July 1st as the earliest date of a litter, and August 31st as the latest.

His nest is an exposed one, frequently built in the standing corn, and rarely in the hedgerow.

It is obvious that, for the welfare of the young, warm dry surroundings are essential, and it is almost startling to compare the recorded distribution of the Harvest Mouse with the July-August rainfall.

The two-inch rainfall contour for July stretches roughly from Sheppey to Worthing, and I regard the country east of this as the headquarters of the Harvest Mouse and the starting point of his distribution. That for August has its north end near Lowestoft, describes a curve whose most westerly point is somewhere near Gravesend, and sweeps back to the sea through Romney Marsh.

The three-inch lines are more irregular, and should be studied on the map.

All the counties in Great Britain from which the Harvest Mouse has been certainly recorded are wholly or partially included between these two-inch and three-inch lines.

It is extremely interesting to note records in this connection from Banff, Kincardine, Cheshire, and Cornwall, and to find how few counties there are with a July-August rainfall of less than three

inches from which the Harvest Mouse has *not* been recorded.

I have no hesitation in saying that although an occasional sporadic record may occur, it is unlikely that he will ever

THE HARVEST MOUSE FEEDING.

permanently establish himself outside the three-inch line, or that he will ever be common north of Leicester.

The breeding-nest of the Harvest Mouse is normally spherical, though its surroundings may considerably vary its shape. Gilbert White, writing on the 4th of November, 1767, likens it in size to a cricket ball (one's thoughts fly straight to Hambledon), but cricket balls have shrunk, I think, since then.

Taking the average of half-a-dozen, they are built a foot above the ground, and composed entirely of the leaves of the corn with the stalks as scaffolding. Occasionally a complete spike is found interwoven in the walls, but this is so rare that it may be considered accidental. Full advantage is taken of the growing leaves of the scaffolding. These are left attached to their stalks, and pulled upwards, downwards, and sideways into the nest, so as to form a stiffening palisade. At the base of the nest there are often three or four entire leaves. The body of the nest is composed of short lengths split longitudinally by the Mouse's teeth, but not entirely picked to pieces; these naturally contract into spirals and complicate themselves. The end of any stalk which hangs down conveniently is treated in the same way. There were 250 split-up but more or less coherent lengths in one nest which I unravelled, and, allowing for miscalculations, I should reckon that at least a hundred complete leaves had been utilised. There is no visible opening, but the structure of the nest ensures that the walls close naturally behind the Mouse's entrances and exits.

I have never found the "winter nest" of the Harvest Mouse, though there is some evidence that such a thing may exist. There seems to be no record as to how many or how few Mice have been found wintering together, but it is extremely unlikely that anything like solitary hibernation occurs with this species. In this part of the country—West Kent—the Harvest Mice winter in the stacks, often scores of them together. They show a decided preference for oat stacks, in which they live on a somewhat higher level than the House Mice. Field Mice and Meadow Mice generally avoid stacks. A number of Mice in a stack means few or no Rats, and a number of Rats means few or no Mice. The most remarkable threshing I ever attended revealed successively (1) a number of Harvest Mice, (2) a litter of Weasels, (3) a number of House Mice.

The tumult of threshing may, of course,

ANOTHER FEEDING ATTITUDE.

have had its effect on the respective positions of the Mice (the Harvest Mouse would tend to go aloft), but there could be no question as to the first-floor position of the Weasel nursery.

NEST OF A HARVEST MOUSE.

I have already described the characteristic white ω which borders the upper lip of the Harvest Mouse. I may, perhaps, add a few further remarks as to their colour generally, which can only be feebly suggested by photographs, and as to the remarkable—indeed, unique—quality of their tails.

The infant Harvest Mouse (I have brought up a litter of seven in captivity) follows the general rule among Mice in being a dingy sepia tint, and taking three weeks or so to find his legs (and tail). The coat of the adult is singularly beautiful. The under surface is pure white, purer, I think, than is to be found in any other British animal. The upper parts shade from a sandy red to a warm rich orange, and between upper and under parts there is a remarkably abrupt demarcation.

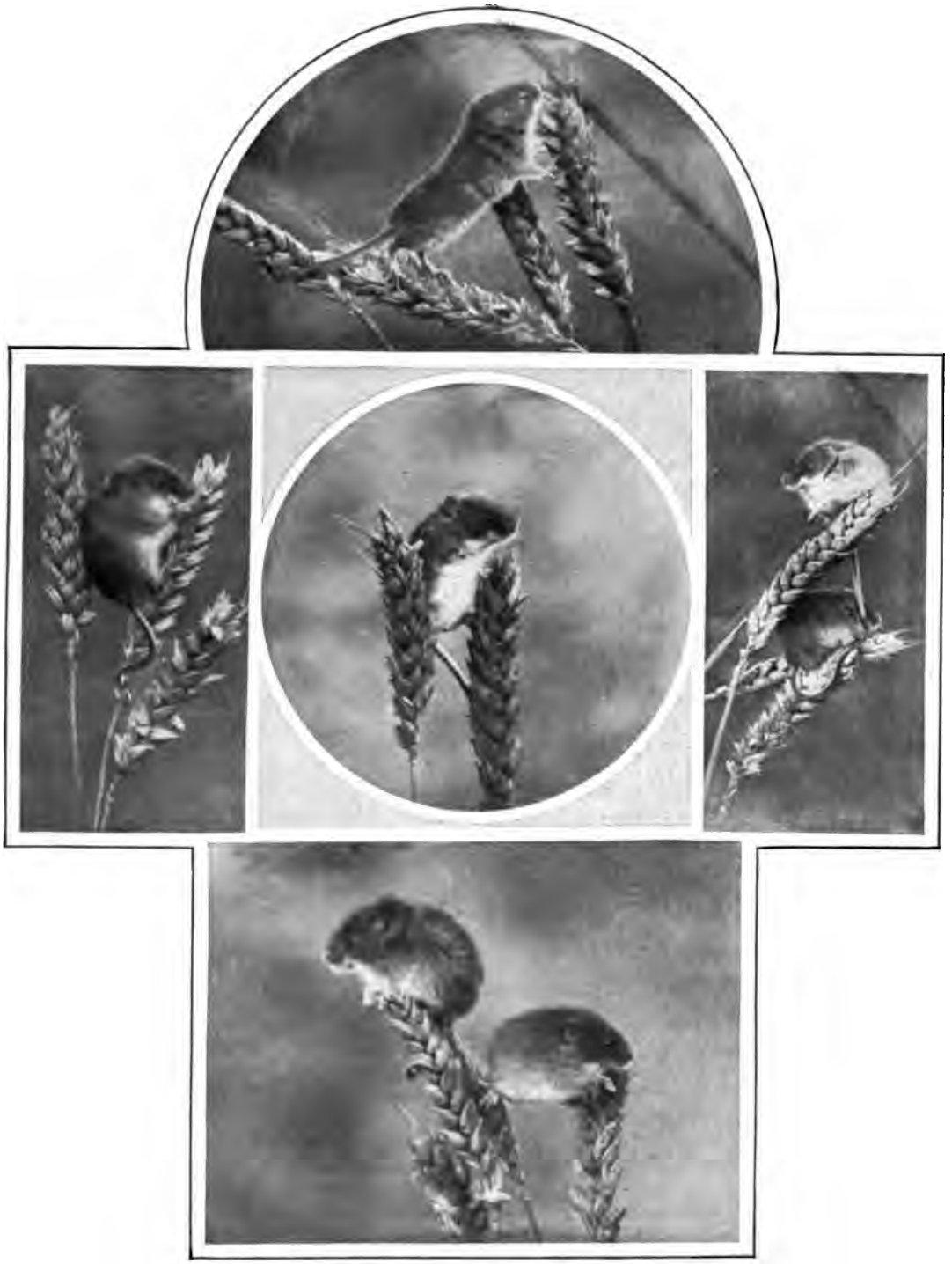
The orange tint is well described by Mr. Harting as "focussed on the hind quarters," but it is noticeable on the flanks and cheeks also.

Contrary to the general rule, the coat appears more brilliant in the winter. This may perhaps be accounted for by a slight bleaching of the sandy portions, which throws the orange into strong relief. The orange tint seems to be wanting in Japanese specimens.

The eye of the Harvest Mouse is distinctly small, his ears are short (for a Mouse) and lie close to his head. A full-face view of him reminds one strongly of a Red-backed Meadow Mouse. Owing to a somewhat blunted nose, his head appears thicker and broader in proportion to his body than that of a House Mouse. His nose is fleshy and very pink. This, I think, is the only drawback to his beauty.

For a long time the Harvest Mouse was considered the smallest British animal (an average specimen measures about 60 millimetres, exclusive of his tail); but the discovery of the Pygmy Shrew Mouse, whose corresponding measurement is about 45 millimetres, deprived him of this distinction, and the Lesser Horseshoe Bat (head and body, 37 millimetres) would, I think, weigh less than either.

The Harvest Mouse weighs from a sixth to a quarter of an ounce. A score of him could go by post for a penny, and ten of him will pack into a cocoanut, —less than three inches any way—and sit there happily for hours. The tail of the Harvest Mouse is unique among British tails in being prehensile. The



STUDIES OF THE HARVEST MOUSE BY DOUGLAS ENGLISH.

grasping portion of it centres in the last quarter inch. This will make a complete turn round a cornstalk, while the remainder is capable of rather more than half a turn. Owing to the under surface being flattened the tail presents an angular appearance, and a section of it appears four-sided. The vertebræ—about twenty-seven in number—reach to the extreme end. Those near the body are stout and short-waisted. The first ten shorten gradually, but the remainder shorten very quickly, becoming slender and long-waisted, and tending away from the centre of the tail to its upper surface. As a result there is little flesh above the bones in the prehensile portion, while below the bones there is a muscular cushion between one and two millimetres thick.

It is not surprising to find that this serviceable organ is incessantly employed, and that the possession of what may be fairly termed a fifth hand has turned the Harvest Mouse into a wonderful gymnast.

The vertical revolutions which a captive squirrel performs round his perch are probably familiar to most people. The Harvest Mouse could give the squirrel a lesson. He can perform a revolution at an angle of 45°, and a revolution which is practically horizontal. Once fairly started he is a living diabolo, and it is delightful to watch four or five perform together. Each does his own particular spin in his own particular way, a hand here, a foot there, a momentary grip of the tail, sometimes upon a fixed support, sometimes, timed to a nicety, on a circling companion. Occasionally two tails become entangled, whereby the combined figure is completely disorganised.

The Harvest Mouse is fond of running straight up a stalk from the bottom to the top, and, so far as most of him is concerned, beyond the top. He retains, of course, the grip of his tail and hind feet, but swings his body this way and that, and, having satisfied himself with the view and the prevailing scent, descends with equal speed, his tail following in a curious spiral motion and evidently acting as a brake.

It is not in movement alone, however, that the Harvest Mouse employs his tail. When sitting still he hitches it round, or braces it against, some fixed support. If no support presents itself he is usually uneasy, and it is amusing, under these circumstances, to watch his tail-end groping for a hold. It twists, and squirms, and asks! If you present your finger-tip it fastens to it gratefully.

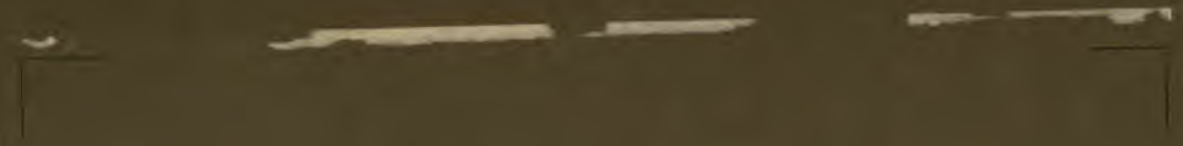
Should he, however, be quite sure of his foothold (and in this case he has usually gripped his support *between* as well as with his toes), he will stick his tail out straight behind him, the prehensile portion being more or less contracted. In time, I think, this tail will do great things. The Harvest Mouse will swing by it and hang by it. At present both these feats are beyond him; but should he cultivate his jumping powers, which certainly need cultivation, he will find them essential.

The staple food of Harvest Mice is grain. Like other small rodents, they will eat insects on occasion, and, like other small rodents, they have an ugly tendency to cannibalism. I once kept a Dormouse and a Harvest Mouse together until the Dormouse devoured the Harvest Mouse, and I have found that a duel between two Harvest Mice in a community usually results in indiscriminate bloodshed and a horrid orgy of feasting.

Normally, however, Harvest Mice are peaceable, gregarious little folk, and if carefully looked after, will live for two or three years contentedly together.

It is probably the restricted breeding season which accounts for Harvest Mice being somewhat less numerous than the other species of Mice in Great Britain. Their litters are large, seven or eight young on the average, and there are probably several litters in the season. I am not aware that they have any peculiar enemies. It is said that cats will not eat them, but I have had some painful experiences to the contrary, and dogs will swallow them wholesale. They are less likely than other Mice to be caught by birds of prey; indeed, I think a Harvest Mouse would seldom be in a position where a bird of prey could get him. There may be a few stragglers left after harvest, in the stubble, but the greater proportion would be carted in the sheaves. Rats, weasels, and snakes probably account for the majority of those whose ends are untimely.

DOUGLAS ENGLISH.



"THE GARDEN THAT I LOVE."
From a Water-Colour Drawing by George S. Elgood, R.I.

THE ROMANCE OF A RIVER

By J. LOMAS, F.G.S., A.R.C.S.

ONE never feels lonely in the presence of a stream. It seems to possess a personality, and we regard it as a companion. Like other companions, it has its moods and is constant only in its changefulness. At one time it is placid and gentle, inviting us to closest communion; at another it is angry, and fierce, almost repellent in its attitude towards us. Still, it is ever fascinating, always drawing us on to closer acquaintance, and it will readily tell us its most cherished secrets if we know how to question and how to read the answer.

"NEAR ITS SOURCE IS A TINY WATERFALL."

Let us take a stream and see how far it can be induced to tell us its story. We choose an ordinary brook such as can be met with anywhere in the country, flowing through meadows and woods to join the mightier rivers and thence to the sea. Near its source is a tiny waterfall over which the water drapes itself into a smooth curved robe in summer, and splashes and foams when in flood. Why should a waterfall exist at this spot? A little hammering will soon show that a bed of rock, rather harder and more resistant than those above and below, is to be found at this point. The efforts of the stream to erode its bed have been checked, and a shelf actually overhangs the rocks under the falls. Immediately below the waterfall the bed of the stream is deep, and in the dry season, when only a little water trickles over the ledge, we see a number of deep holes which look as if they had been drilled vertically by a revolving tool. And so they have. The falling water has caused the stones which have

POT HOLE AT THE BASE OF A WATERFALL CONTAINING ROUNDED STONES.

been carried over the falls to swirl round and round, and in turning they have excavated the hollow by slow degrees.

The hollows are called "pot holes," and at the bottom of each cavity we see one or more smooth, rounded stones which in abrading the rock have themselves become abraded.

By contact with their fellows and with the world about them, they have lost their roughness and angularity and have been shaped into smooth and polished specimens of their kind. In the upper reaches the stream, full of youthful vigour, and impatient to reach its goal, cuts a channel straight and deep. It leaps the obstacles in its path, rests a little in a quiet pool to gather strength, and then sets out again on its impetuous career.

When it reaches the plain below, where the ground is covered with softer materials, such as clay, mud, and sand, it begins to meander from side to side. The slightest obstacle, such as a fallen tree or a big boulder, will cause it to swerve from the straight path. At first the swings are but little removed from a straight line, but as we proceed further down-stream they become more and more acute, until a big circular sweep is taken which almost loops the stream on itself, and only a foot or so of soil prevents the water from cutting across the barrier and flowing on in a straight line.*

When this has been accomplished it once more pursues a direct and un-

* Since the above was written (March, 1908) the barrier has been cut through and the main current has been diverted from the curved channel (*see* p. 93).

"BY CONTACT WITH THEIR FELLOWS . . . THEY HAVE LOST THEIR ROUGHNESS AND ANGULARITY."

bending course, but swampy ox-bows of stagnant water, alternating on each side of the stream, tell of sinuous wanderings in the past.

As we follow the river down-stream we find, after a time, the course once more begins to waver, the loops become more and more pronounced, and then another straight length follows. Thus we see the process of straightening proceeds up-stream, and the two phases follow each other in rhythmic pulses.

"THEN SETS OUT AGAIN ON ITS IMPETUOUS CAREER" (p. 90).

The swings of a river are sometimes compared with the swings of a pendulum. The latter, we know, are very regular, and are used as a means of measuring time. A clock is only a counting machine, which indicates by the position of the fingers on the dial how many oscillations the pendulum has made.

So, in a stream, if not disturbed by outside influences, the meanders follow definite harmonic laws, and their size depends upon two factors — the volume of water, and the velocity. In the course of the small brook which we are following we occasionally meet with a loop two or three times as large as the normal, and

"A FALLEN TREE WILL CAUSE IT TO SWERVE FROM THE STRAIGHT PATH" (p. 90).

"AT FIRST THE SWINGS ARE BUT LITTLE REMOVED FROM A STRAIGHT LINE——" (p. 90).

when this occurs a tributary always enters on the outer bend of the curve.

There are two ways in which we can approach the study of a stream; one is the statical method, the other is the dynamical method. The first would be content with an answer to the question "What is it?" The second seeks rather to find an answer to the query "What does it do?" It is the aspect of doing, which we shall keep in mind in our further investigations.

Now let us question the river closely as to its activities, and particularly as to the characteristics of its flow. It is not difficult to get exact knowledge on this point if we conduct a few simple experiments. Choosing a suitable place in a straight length we throw light objects on the surface. Pieces of paper or twigs will serve, but if the wind is blowing it is best to use a substance like sawdust, which will offer the smallest possible surface to the currents of the air. If a series of floating objects start at the same time from a line drawn across the stream, we soon observe that those near the middle outstrip those at the sides; in other words, on the surface the line of maximum velocity is near the centre. We can compare the rate of flow of surface and bottom water by putting a coloured substance soluble in water on the bed of the stream. A coloured liquid such as ink would do, but it is not easy to get the liquid to the bottom without colouring the water above. A very convenient substance is lump sugar which has been soaked in an alcoholic solution of magenta. If a cube of sugar so prepared is dropped in the stream, it sinks to the bottom, slowly dissolves, and sends out a thin, red line in the direction of the flow. In this way it may be demonstrated that the surface water moves faster than that at the

"BUT AS WE PROCEED FURTHER DOWN-STREAM THEY BECOME MORE AND MORE ACUTE" (p. 90).

"THE BARRIER HAS BEEN CUT THROUGH AND THE MAIN CURRENT HAS BEEN DIVERTED FROM THE CURVED CHANNEL" (p. 90).

bottom. It is worth while trying to picture in the mind the characteristic movements as revealed by these experiments. If a plank of wood were sliding down a hillside, all the particles would move at the same rate and preserve their relative positions, but in the case of water we find the upper layers are sliding and shearing over the lower, and the middle parts are tearing their ways through those at the sides.

Now what is the nature of the flow in

"SWAMPY OXBOWS OF STAGNANT WATER . . . TELL OF SINUOUS WANDERINGS IN THE PAST" (p. 91).

"ON THE INNER PART OF THE BEND THE GROUND IS LOW AND SLOPES GRADUALLY TO THE WATER'S EDGE."

the meandering portions of the river? Before dealing with this question it will be well to acquaint ourselves with certain features which can be observed at a bend. On the concave or outer part of a bend we note the banks are, as a rule, lofty, cliff-like and steep, whereas on the convex or inner part the ground is low and slopes gradually to the water's edge. The strand on the inner curve consists of sand or gravel, and it is usually triangular in form. American geographers call it the "toe-cap," from its resemblance to the end of a pointed boot. If the sloping bank is followed down and across the stream, it is found to end in a pool of deep water which lies immediately under the cliff on the outer curve. We have no term in general use in the English language which applies to this feature, but I once heard a Welshman describe it by a word which translated into our tongue means "turnpool," and in North Lancashire it is occasionally called the "wheel." We may take it as a general rule that the stream is deepest under the lofty cliff and shallows towards the low banks.

If we make experiments to test the flow at a bend, we note striking differences as compared with the results obtained in the straight parts.

The line of maximum flow does not follow the middle line of the stream, but takes a curve more sharply bent as shown by the dotted line in the diagram. If we watch the foam bells carried down by the current we see that they cling to the turnpool side and seem to avoid the toe-cap, and reeds and grasses growing in the brooks show, by the trend of their blades, the direction in which the current is flowing.

We can test the bottom flow by means of prepared sugar. On dropping a cube into the turnpool we find the movement is very sluggish as compared with the surface. An aureole of coloured liquid gradually forms round the sugar and then begins to drift with the current across the bed towards the toe-cap. (Indicated in the diagram by arrows.) The toe-cap is the direct product of this cross bottom current, and has been

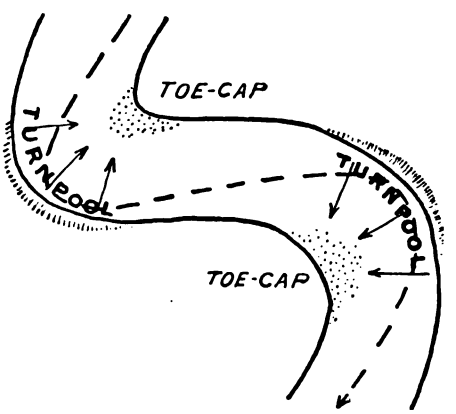


DIAGRAM SHOWING THE FLOW OF A STREAM.

formed by the gradual rolling of material towards the inner bend. Why should the undercurrent at a curve be across stream?

Careful measurements will soon show that the level of the surface is not the same at the toe-cap and over the turnpool. The direct rush of water towards the outer bend causes a heaping up at that place, and the head of water induces a cross flow.

Another line of inquiry is opened up with regard to the activities of a stream, when we consider the work it does in carving out the valley in which it flows, and its effect in modifying the contours of the land. How can moving water, so pliable and yielding, cut through even the softest rocks ? Well, of itself it cannot, unless the rocks are soluble, but it can carry sand and stones in suspension or roll them along its bed, and the constant abrasion of the carried particles on the solid rocks slowly but surely causes them to yield. We should expect that the general result of running water armed with moving sand would be to produce gorges with steep parallel sides just like a vertical saw cutting into wood. That is exactly what would happen if the stream were the only agent at work. But the effects of frost, rain, and other influences are also important in the carving of the land, and a large part of the work of disintegration is done by these agents.

Their function is to widen the valley and grade the sides to a gentler slope. In those parts of the world where rain and frost are seldom met with, as in Colorado, we see the effects of the river action alone. The wonderful cañons show exactly what a river can do if left to itself for long ages. But the work of the river is not confined to the breaking up of rock masses. The disintegrated material must be carried away and deposited somewhere. In the upper reaches, where the path is steep and the current rapid, large boulders may be carried. It seems almost incredible that the tiny stream we see under ordinary circumstances should be capable of moving such large stones. In some mountain streams certain boulders have been marked and their positions carefully ascertained. Observations made year after year show that the marked boulders do move, and their rate of movement has been determined.

When it reaches the plain the current is sluggish and only capable of transporting the finer materials. There is a beautiful and delicate adjustment between the current and the material carried. The balance is disturbed in times of flood and excessive drought, but when these abnormal phases have passed, the stream adjusts itself once more and returns to a state of equilibrium.

We have now followed our type stream from the hills to the plains; there is still another part of a stream where it empties itself into the sea. Long before reaching this stage our little brook has joined its waters with others to form a large river, and the estuary can best be discussed when we pass in review some of the characteristics of larger examples.

J. LOMAS.

"IT SEEMS ALMOST INCREDIBLE THAT THE TINY STREAM SHOULD BE CAPABLE OF MOVING SUCH LARGE STONES."

HOW TO KNOW THE WILD FLOWERS

By the REV. H. PUREFOY FITZGERALD, F.L.S.
With Photographs by HENRY IRVING

THE FLOWERS OF THE WOODLANDS

THE DAFFODIL.

THE woodlands provide us with the choicest of our wild flowers, not because of their rarity but on account of their profusion and their great but simple beauty. Beginning with the carpet of Wild Daffodils in the early spring, to be succeeded by masses of Primroses and Wood Anemones, and after these the Bluebells, making the ground appear a sheet of blue colour, what can be found more entrancing to the lover of flowers than a stroll in the spring and early summer through such a copse where this succession of flowers is to be found?

THE DAFFODIL

The Daffodil, or Daffy-down-dilly (*Narcissus pseudo-narcissus*), is one of the earliest heralds of spring, and as such, apart from all other reasons, is a most welcome sight. The pity is that it is not more common, for it is somewhat local, and it has disappeared from many of its former haunts, owing to the ruthless digging up of its roots for transplanting.

THE PRIMROSE.

It belongs to the family of *Amaryllis*, many members of which are very well known; it includes, beside the many forms of Daffodils now in cultivation, the Snowdrop and the two Snowflakes. The name Daffodil is probably derived from the old Latin name *asphodelus*, which was turned into Affodilly, which was further corrupted into Daffodilly.

THE PRIMROSE

The Primrose will introduce us to another family of plants, many of which are great favourites on account of their simple beauty. Notice that the leaves are all undivided, and that the green calyx (the cup into which the petals are inserted) is not divided into separate sepals; these are united, forming a tube; the sepals may be traced in the five pointed teeth. The petals also are joined, the corolla, as it is called, being divided into as many divisions as there are teeth in the calyx; similarly the number of stamens are the same as the number of divisions of the corolla, to which they are attached. If several Primrose flowers are examined, it will be seen that there are two different kinds: one in which the pistil has a long stalk or style, so that it peeps up just above the top of the tube, and the stamens are arranged on the

WOOD ANEMONE.

petals some little way below. In the other flower, just the reverse will be found; the stamens are to be seen near the top, while the pistil is quite short, so that the top of it, the stigma, reaches about half-way up. "Pin Eye" and "Thrum Eye" the two forms are commonly called, and it is a striking example of how Nature does her best to promote the cross fertilisation of the species. Imagine an insect visiting one of the first forms, a "Pin Eye," flying on to a flower and thrusting its proboscis well down into the tube after the honey at the bottom; the arrangement of the stamens is such that the pollen would dust that part of the proboscis which, in the next flower visited (supposing this to be one of the "Thrum Eyed" forms), would come just opposite the stigma on the top of the short stem, and the pollen would be rubbed against it. If the flowers were visited in the reverse order, the same ends would be accomplished, but at a different place on the proboscis. The pollen also, if it is examined under a microscope, will be found to be larger in the case of the "Thrum-Eyed" forms, since it will have to send out a tube that will travel down the long-stemmed pistil; so that under circumstances like these it is very improbable that a flower can be fertilised by its own pollen. The same arrangements will be seen in the Cowslips, Oxlips and Polyanthus, all of which are very nearly related to the Primrose.

BLUEBELL OR WILD HYACINTH.

WOOD ANEMONE

Growing among the Primroses, and generally in considerable quantity, the Wood Anemone (*Anemone nemorosa*) will be found flowering at the same time. It is a near relation to the Buttercup. The flower disperses with petals altogether, and in place of this has six white sepals, which are very conspicuous, and it is just as well that they are so, as the flower secretes no honey to attract the insects. The Wood Anemone has very pretty foliage, each leaf being divided into three leaflets, and these again are often divided nearly to the base. Apart from the ordinary leaves, which do not appear until the flower has expanded, may be found three wedge-shaped leaves halfway up the stalk. When the blossom is still in bud, the flower stalk is curled and the bud is protected by these special leaves being folded over it. The Anemone acts as a barometer, for on the approach of rain the blossoms close and hang their heads so as to shelter the pollen and other parts from the wet; they close also at evening. The name Anemone is derived from a Greek word meaning the wind, whence the common name, Windflower; but why it was so called it is difficult to say. Pliny, in his Natural

WOOD SORREL.

History of plants and animals, declares that it was because the flower never opens unless the wind is blowing.

THE BLUEBELL

The Bluebell or Wild Hyacinth (*Scilla Nutans*) is a well-known favourite, and nothing is more charming than masses of these growing under the trees, giving, in the distance, the idea of a blue carpet. The plant springs from a white bulb, full of juice, and the leaves and flowering stems all rise straight from the ground, the former being shorter than the flower stems. The flowers are borne in a one-sided raceme or row, each one drooping on its tiny stalk, and each one with a small leaf or bract at the base; the blossoms hanging down as they do from the flowering stem are well protected from the rain.

WOOD SORREL

The Wood Sorrel (*Oxalis Acetosella*) belongs to the Geranium family; it is one of our most graceful wild flowers. It delights in a moist, shady spot, and flowers about April or May, and is very often in the company of Primroses and Wood Anemones. Dig up a plant and you will see that it has a slender, creeping rootstock, which is generally covered with bright red scales. The leaves spring from this, each leaf bearing three leaflets, like the clover, green above and somewhat purple beneath; these leaves droop as

WILD STRAWBERRY.

WOOD SPURGE.

night approaches and also in bad weather, and they will often do so if the stems are sharply struck. One rather large white flower is borne on each peduncle, and if one of these is examined it will be seen that it has five small green sepals, five petals, with delicate purplish-pink veins, and the stamens arranged in two rows, and five stigmas, while half-way up the flower stem will be seen two tiny little leaves or bracts. The seed vessel is worth looking into: it is surrounded by a cup-like covering which is very elastic, and when this arrives at a certain state of dryness, any small shock is sufficient to make it burst, and the seeds are flung out in all directions with considerable force.

The Wood Sorrel is an example of those plants which produce two distinct kinds of flowers, for during the summer may be found a number of buds which never open, but which eventually develop into seed vessels; the Violets also have this peculiarity.

This plant was in all likelihood the original Shamrock, being used by St. Patrick as a symbol of the truth of the Trinity, but the name is now applied to other trefoil plants, and this plant is no longer used as the Shamrock on St. Patrick's Day. Other local names for it are Three-leaved grass, Cuckoo's Meat, Cuckoo Sorrel and Stub-wort, the latter because it often grows among tree stubs. The leaves have a very acid flavour, and are sometimes used for salad; the acidity is due to a salt of oxalic acid, which can be obtained as crystals by distilling the leaves.

FOXGLOVE.

WILD STRAWBERRY

The Wild Strawberry (*Fragaria vesca*) will be found in flower from May to July, and will be readily recognised from its similarity to the cultivated kinds, but possibly, as was pointed out in the chapter on Wayside Flowers, the Barren Strawberry (*Potentilla fragariastrum*) may be mistaken for it. On examining the fruits of the two plants, the difference will be readily seen, for in the *Potentilla* the fruit is heavy and dry and very uninviting. In the Strawberry it is red and luscious; and the difference will be noticed in even the early stages of fruiting. The leaves are dark green in colour and divided into three leaflets, more or less covered with soft, silky hairs. The plant sends out runners from the rootstock, which creep along the ground, and these at intervals take root, forming at each joint a new, young plant, so that the Strawberry has discovered a way of increasing its own species, apart from its attractive fruit. As to the name, there is some doubt as to why it was adopted. The old spelling was Streowberry, and a local name was Strayberry. It seems likely that both of these have come from the runners being strewn on the ground, enabling the plant to stray from home.

THE WOOD SPURGE

The Wood Spurge (*Euphorbia amygdaloides*) is a curious-looking plant, very commonly found in the South of England, but not so frequently in the Midlands, and still rarer in the North. It belongs to a family of plants some of which are very poisonous, and a few possess valuable medicinal properties, such as the Castor Oil plant. The stems are generally of a reddish colour, and most of the green flowers spring from the centre of a rosette of leaves, forming an umbel; a few single flowers are also to be found up the stem. Each bloom consists of a pair of yellowish-green floral leaves, which are connected so as to form one large, round leaf; inside will be seen several stamens, and in the centre a female flower, supported on a short stalk, and curving downwards; in reality, each stamen is a single male flower, so that we have here an instance of many single flowers being collected in one head, a sort of co-operative society; you will notice also some curious crescent-

WOOD SANICLE.

shaped glands with rather long points. The milky juice of this plant is extremely acid, and has an ulcerating effect on the skin. It is sometimes used to cure warts, but it has to be applied with great caution, and, in fact, had better be left alone.

FOXGLOVE

The stately Foxglove (*Digitalis purpurea*) is a well-known denizen of the woodland, and a copse where this plant is growing in masses is a sight worth seeing. Several facts which have already been noticed with regard to other flowers are also to be observed here. The long stem bears a great many blossoms, so that the insect visitors need waste no time in

passing from flower to flower and collecting the honey situated deep down at the base. Watch a plant, if you have the time, and look for a humble bee alighting on the bell. You will see that the shape of the flower agrees exactly with that of the bee's body. And this is, in fact, the only insect that fertilises the plant. The stamens ripen before the pistil, two at a time, and at first the anthers, where the pollen is stored, are in a horizontal position; when ripe, these become vertical. The pendulous habit of the blossoms protect the various organs from the rain.

As to the name Foxglove, no one seems to have been able to give a satisfactory derivation of it, and the meaning will probably remain in obscurity.

WOOD SANICLE

Another plant which is frequently met with is the Wood Sanicle (*Sanicula europæa*) with pretty, divided, very glossy foliage, and small, round heads of white flowers, arranged in an umbel. The small, outer flowers bear stamens only; the front is flattened and oval in shape, and is provided with numerous hooked prickles, which catch hold of anything that touch them, so that they have the chance of being widely disseminated. The flowers will be found during June and July.

H. PUREFOY FITZGERALD.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.
Author of "Wee Tim'rous Beasties," etc.

THE DORMOUSE

With Photographs by the Author

MOST of us, I imagine, derived our first conception of a Dormouse from the immortal tea-party:

"'Treacle,' said the Dormouse, 'without considering at all this time.'"

Whereby hangs an amazing tale. Messrs. Newstead and Walker, while moth-collecting at Colwyn Bay, captured a Dormouse at sugar.* This Dormouse, I think, must have been like his captors—an entomologist. A Hedgehog has a low taste for rum, but a Dormouse? Yet there is a record of one nibbling honeysuckle for the nectar, and it must be confessed that a Dormouse is by no means particular in his diet.

The following are some of the eatables which have been described as welcome to him by various authors: hazel-nuts of course, acorns, grubs, birds' eggs, apples, grapes, raisins, bacon fat, cherries, any kind of corn, porridge, bread and milk, and sponge cake.

* Proc. Chester Soc. Nat. Science, 1893, p. 248.

In spite of the historic complaint of the little girl that her Dormouse "had no habits," he is, and will always be, a favourite pet for the nursery. "It has no smell, either good or bad," writes Buffon gravely. But, apart from this excellent quality, a vicious Dormouse is exceptional. "'I wish you would not squeeze so,' said the Dormouse . . . and he got up very sulkily and crossed over to the other side of the court."

That is the Dormouse all over. He resents over-attention. He will move (sulkily, if you will) as far from you as possible, but he will never bite.

Well—hardly ever.

One sits beside me as I write, and him I can only describe as a savage little beast. He has often tasted my blood, but I cherish some affection for him. The world has used him hardly. He was caught in March, 1907, full grown and, for the time of year, robust. One ear had gone, and three parts of his tail.

Both wounds had been long healed. There was a crinkle where an ear should be, and hair concealed the indecorous tail-stump.* A slashing blow this must have been. An owl, perhaps; more probably a cat. I doubt if Dormice fall a prey to Owls. The food of Owls can be very fairly determined by their pellets. I know no case of the remains of either Harvest Mice or Dormice. Those of Shrews, Field Mice, House Mice, and Meadow Mice are common.

THE DORMOUSE.
Showing the large size of his eyes and stoutness of his feet and hands.

A loss of tail must, one would think, be a serious matter for a Dormouse. Yet, as youthful investigators are quick to discover, the tail strips easily. Why it strips easily I know not. The rings are decidedly closer together than is the case with the true Mice, almost in the proportion of three to two, and the tail is very fleshy, measuring, without the hair, about four millimetres across, and double this with the hair. The hair grows on it in a succession of whorls, and its under surface presents in a good light a distinctly banded appearance.

In his active period—say April to November—there is little doubt that the Dormouse employs his tail as a parachute. He is a prodigious leaper, but his movements are generally so quick and so difficult to follow among the branches, that I have not been able to satisfy myself of the way he carries his tail in jumping. I am inclined to think that it is arched downwards, and that its hair, as well as the hair on his sides, spreads out and steadies his flight.

The Dormouse sleeps, after the fashion of mouse-kind, with his head tucked down, his four limbs brought well together and his tail swept round outside him.

During hibernation, however—that unconscious portion of his existence from which presumably his nickname "Sleeper" is derived—his attitude is, as may be seen from the picture (p. 104), peculiarly constrained.

Animal hibernation has but little in common with sleep. It may be roughly defined as a condition of torpidity induced by a fall of body temperature, and in some of its features—rigidity, for example, and response to certain stimuli—presents an hypnotic character.

Hibernation may be complete or partial. In complete hibernation, a condition which is induced in the Dormouse by a fall of body temperature a degree or two below 50° F., the vital functions are, to all outward appearance, completely suspended.

The Mouse has no power of voluntary motion; its breathing is imperceptible; it is cold to the touch. Anyone unacquainted with the condition would certainly assume it to be dead.

* Since writing the above my small friend has died. A post-mortem revealed that half his upper jaw had been carried away also.

I do not know that any reliable investigations have yet been made of the circumstances attending normal hibernation in animals. The investigation is, in any case, an extremely difficult one, and one of the most interesting points in connection with it, the determination of the body temperature of the animal in relation to the temperature of the surrounding air, must always involve the risk of gravely disturbing the normal conditions, if not, indeed, of killing the animal outright.

HIBERNATING DORMOUSE.
The attitude is designed to shield the vital organs.

Such evidence as exists seems to show that the body temperature of a hibernating animal corresponds fairly closely with the temperature of the surrounding air, so that we have the remarkable phenomenon of a warm-blooded animal assuming, during certain definite periods of its existence, one of the peculiar characteristics of a cold-blooded animal.

The question as to what happens when the temperature of the surrounding air falls to freezing point will naturally present itself, and it must be remembered that, in the case of animals like the Dormouse and Hedgehog, whose winter quarters are above ground level, such a contingency is by no means impossible.

It is inconceivable, from a mechanical standpoint, that either of these highly organised animals could survive being actually frozen. We must assume, therefore, either that extreme cold will rouse them (in the Hedgehog a body temperature of 38° F. has been recorded), or, as is more likely, that there is some working source of heat within their bodies which, slight though it may be, is yet sufficient to keep their body temperatures under all circumstances above 32° F.

I cannot regard the usual explanation, that

DORMOUSE.
Showing the bushy character of the tail and the apparent shortness of the limbs.

this heat is supplied by the slow combustion of fat amassed during the summer, as convincing. It is by no means certain that hibernating animals lose weight normally, and it is difficult to see how, in the absence of respiration, perspiration and excretion, the products of such combustion are got rid of.

It would seem more reasonable to suppose that Nature has devised some scheme of utilising inside the animal the considerable heat which becomes latent when the animal, in the ordinary course of its existence, is breathing or perspiring.

There is no doubt, I think, that the distribution of the Dormouse is primarily governed by the same causes as those which determine the distribution of the Harvest Mouse. He has a short breeding season (August and September), and he builds an exposed nest above ground level. So long as his young are hairless they require warm, dry surroundings.

His breeding-nest is more substantial than that of the Harvest Mouse, and, since the absence of sunshine is not of much concern to him, it is not surprising to find that in Wales he ranges westward of the three-inch August-September rainfall. The four-inch line, however, checks him.

The normal winter sleep of the Dormouse commences in late October and lasts till April. His progress northward has naturally stopped where the mean October temperature falls below 50° F.

He is therefore unknown in Scotland, and rare north of the Midlands.

Mr. Forrest has studied the breeding habits of the Dormouse, and finds that "the doe constructs a fairly large nest for the reception of her family, placing it either in a hedge or in a hazel or other small tree, especially such as are draped with hanging masses of honeysuckle."*

This preference for honeysuckle is curious; the plant may be seen in my photograph of a nest. It is possible that the mother may find honeysuckle a good tonic.

Mr. Forrest proceeds to tell us that "the buck constructs himself a separate nest within a few yards." The picture of father-mouse being relegated to the spare room is delightful. One would like to think of the pair supervising the construction of the youngsters' winter quarters, and of a general reunion in the spring, but facts, I fear, are against it.

NEST OF DORMOUSE IN FURZE-BUSH IN WHICH HONEYSUCKLE IS ENTWINED.

The winter nests are quite separate from the breeding nests, and never contain more than one tenant. Cases have been known of the adaptation of an old birds' nest, but generally they are situated about ground level, and composed of moss and fairly substantial leaves.

The Dormouse does not look like a jumper. One misses the muscular

* "Fauna of North Wales," H. E. Forrest.

development of the hind legs, which is so noticeable in the Field Mouse and the Squirrel. The difference, I think, is merely an external one, and is due to the fact that the looseness of his skin, and the shortness of his feet and hands, which appear to issue straight from the fur, conceal to some extent the true set of his limbs. He has enormous muscles on the shoulder and upper arm, as well as on the thighs. The feet and hands are stoutly built. In the latter the pads at the finger-tips and between the bases of the fingers are rather small, but the two at the wrist are extremely large, and the shortness of the palm brings all ten pads close together, forming an excellent cushion on which to land his weight. The pads of his hind feet, owing to the shortness of the sole, coalesce in a similar way.

NUTS GNAWED BY MICE.
Upper row gnawed by Long-tailed Field Mouse. Middle row by Dormouse. Lower row by Red-backed Meadow Mouse.

For a non-burrowing animal, he has a well-developed collar-bone; and his internal structure renders it impossible for him ever to fall a victim to appendicitis.

His eyes are extremely large and beautiful, projecting strongly from the head and possessing probably an even greater range of vision than those of the Field Mouse. It is interesting in this connection to note that the Dormouse does not crouch and depress the nape of his neck when frightened. Flight is his first impulse.

Being essentially a twilight beastie the Dormouse is seldom seen abroad, and the first clue that one has to his presence in a garden (he is fond of gardens) is the *débris* of his meals. The nut which the Dormouse has eaten is unmistakable. Squirrels, Field Mice, and Red-backed Meadow Mice attack their nuts impetuously. The Squirrel scarcely troubles to gnaw at all. A scratch or two gives him a tooth-hold. Then he bites sharply. Often the shell splits cleanly in two portions. Sometimes it needs a second bite. The whole action is impatient.

The methods of the Field Mouse and Meadow Mouse resemble each other. Both gnaw somewhat at random, and will sometimes leave a spot where they have reached the kernel, and give themselves the additional labour of making another entrance. This is largely due to the fact that they fumble with the nut, and do not lift it. If all goes well, however, their first incision is near the pointed end of the nut, and from this their working spreads irregularly. They gnaw a certain space, eat as much as they can reach, and then gnaw on.

The Dormouse is more workmanlike. He sits back on his haunches and lifts the nut between his hands. Usually he holds it with the point towards himself, and invariably, I think, he commences at the edge of the circular patch.

The finished hole is remarkably regular. In a fat, round nut it is circular, in a long, thin nut it is elliptical. The diameter, when circular, and the long diameter, when elliptical, are strictly proportional to the dimensions of the nut, and a series of measurements has shown me that with a hole of 7 millimetres diameter, and a depth of not more than double this from the edge of the hole to the uttermost parts of the nut, the Dormouse can manage the entire kernel. Considering that a hole of this size only admits his nose to the extent of about 6 millimetres, one cannot but admire his skill and wonder how he does it.

DOUGLAS ENGLISH.

HOW TO KNOW THE TREES GROWING IN BRITAIN

With Notes, descriptive and photographic, for their Identification in all Seasons of the Year

By HENRY IRVING

THE SWEET CHESTNUT

WE are compelled to conform to common usage in speaking of this tree as the Sweet Chestnut, as though it and the Horse Chestnut were in some way allied; whereas they are not even distantly related. Except for the single fact that their fruits (though one is a fruit and the other a seed) are somewhat similar in outward appearance, they differ in every possible particular. This is *the* chestnut, whatever the Horse Chestnut may be. Native to the Sunny South lands, it is said to have been brought here by the Romans; so it has had time to make itself fairly at home. Yet it is chiefly to be found in planted parks and not in our wild woods. It is, however, much used as undergrowth to form cover for game.

TRUNK OF SWEET CHESTNUT.

In force of character the Chestnut is a close rival of the Oak. Growing more erect, it, nevertheless, gives a similar impression of sturdy strength. There is something gladiatorial in its pose and bearing. Firm-set, erect, massive, muscular, it were no very far flight to imagine a readiness to give, or take, blow, or throw.

In *winter* the sturdy column of the central stem is seen to taper little to a considerable height. It bears comparatively short but heavy branches which follow a like habit. These are carried horizontally as on the Oak. They dip more at the extremities, and are retained generally at a lower level, often sweeping the ground. The smaller branchings from these have a drooping tendency, which may be compared to falling drapery from an extended arm.

In *spring* the first colour of the young leaves, spreading over the surface of the tree, is ruddy. This soon gives place to a clear, deep green. Not till late spring, or even early summer, do the catkins

mature. Then the whole tree glows from lowest branch to summit with stars as of pale gold, radiant.

SWEET CHESTNUT LEAVES.

In *summer* the general effect is massive, with rounded mounds of foliage completely covering and hiding, as with a thick mantle, the sturdy limbs; deep green, but relieved by light reflections from the bright leaf-surfaces.

In *autumn* the colour changes to lemon yellow, deepening to gold, and then to dull brown in the fall, which takes place earlier than with the Oak and Beech; but beneath the Chestnut is no rich glistering carpet of leaves, only dull, sodden brown.

The *trunk* is columnar, tapering little, upstanding to the summit. The *bark* is thick and deeply furrowed. The furrows are longitudinally placed, but in age tend to twist, presenting sometimes the appearance as of thick strands in a great cable. The colour is dark grey. The *winter twigs* are brown, stiff, angular, with strongly defined ridges passing upwards as though to support the prominent leaf cushions, above which, as upon brackets, the resting buds are placed, though somewhat awry in relation to the leaf-scars. The *resting buds* are yellowish green changing to red, thick-set like those of the Oak, but show only two outer scales. They are arranged alternately on the twig, but on erect shoots the arrangement becomes spiral. The leaf-scar is triangular with angles rounded off, and shows usually three groups of leaf-traces. The *leaves* are large, 7 to 9 inches long, narrow in relation to their length, tapering to a point at each end. They have decided teeth at regular short intervals all round, these having a forward direction like those of a "rip" saw. The midrib is in continuance of the stalk to the apex, with ribs on either side (about twenty pairs of them), each ending in a sharp tooth at the margin.

The *flowers* are arranged in catkins, of which there are two kinds, both found on the same tree. These are simple catkins with pollen-bearing flowers only, and mixed catkins with both pollen-bearing and fruit-producing flowers. Both stand erect, appearing at the junction of leaf-stalk and twig of the current year. They do not mature till the leaves are fully grown. Arranged more or less spirally on the twigs, they radiate as stars when seen from a distance. Examined separately, each emerges from among the shield-like leaves as a glittering lance-head exquisitely poised. The catkins with pollen-bearing flowers only grow lower down the twig, and mature first, putting out their many stamens from the base

SWEET CHESTNUT WINTER TWIG AND ENLARGED VIEW OF BUD WITH LEAF-SCAR.

SWEET CHESTNUT IN WINTER AND SUMMER.

upwards. The mixed catkins grow near the tips of the shoots, and carry pollen-bearing flowers on the upper four-fifths of their length. On the lower one-fifth are two or three green rosettes with reddish threads protruding. These are the fruit-producing flowers. The pollen is conveyed from flower to flower mainly by the wind, but also to some extent by the visitation of numerous small insects that find the catkins in some way attractive to them, though the flowers secrete no nectar.

The *fruit* is enclosed in a casket which presents the appearance of a diminutive hedgehog on the defensive, with sharp spines projecting every way. When ripe this casket splits open crosswise, exposing the brown nuts. In this country, as a rule, not more than one of these nuts matures. It is roundish, drawn up to a point, something like a bag of which the strings have been tightly drawn to close it when full. Those that have failed are like similar bags, but empty, with their sides pressed together. At the top of the nut stands erect a little tuft, the remains of the stigmas from the time of flowering.

HENRY IRVING.

HOW TO KNOW THE BIRDS

By the REV. MAURICE C. H. BIRD, M.A., M.B.O.U.

With Photographs by
RICHARD AND CHERRY KEARTON

TITS, PIPITS, AND LARKS

THE chief distinctive mark of the Golden-crested Wren is its diminutive size. It is the smallest British bird. About five of them go to the ounce! In body colour they approach the Willow Wren, but are not quite so delicately elongated in appearance, and are more Tit-like in their habits and attitudes. Both male and female have the yellow crown, but it is not developed in the young until after the first month. The sexual difference in the depth of colour might lead a casual observer to mistake the male Gold-crest for an example of the rare Fire-crest, but the latter, besides having a really deeper orange crown, and being a slightly larger bird, has also a dark eye-stripe extending to the nape of the neck. Both species are partial to coniferous trees, and young plantations of such are especially attractive. Gold-crests frequently choose the Spruce Fir as a nesting site, but where unclipped Yews abound their lovely, somewhat Chaffinch-like nest is more usually suspended from the ends of branches of the last-named tree. It is a marvel how these tiny specks of bird life can endure a sea passage, but thousands reach the East Coast from the Continent every autumn,

YOUNG BLUE TIT.

COAL TIT VISITING ITS YOUNG.

and it is at this season of the year when they are most likely to attract the attention of the roadside naturalist, for when summer foliage clothes the trees and bushes such minute birds may easily escape notice. Moreover, fewer remain to breed with us than winter here.

The Tits too, as their name suggests, are a family of very small birds, remarkable for their activity and energy, being constantly on the move, flitting and climbing about in search of food, their curious attitudes and acrobatic performances being delightful to watch. The Great Tit is, as its adjective implies, the largest of the five commoner representatives of the family—a bold, handsome bird with white cheeks and yellow waistcoat divided down the middle by a jet black stripe. The Blue Tit is conspicuously named, and cannot at any age or season be confounded with either of its congeners. Both these birds are easily attracted to "bird tables" in winter, and delight in a suspended cocoa-nut or piece of suet. The less widely distributed, or at any rate less common and confiding Marsh and Coal Tits, may be distinguished from one another by remembering that the former has no conspicuous white at all on the head, nor yellow on the breast, whilst the latter has a patch of white at the base of the skull, the nape of the neck as well as the cheeks being white, which distinguishes it from the Great Tit, the latter being quite an inch longer than either Marsh, Coal, or Blue Tit.

All four species nest in holes of trees or masonry, the Great and Blue Tits being most easily accommodated, utilising upon occasions most curious nesting sites—a letter box or a disused pump. Marsh and Coal Tits are more shy and retiring, the former seldom venturing near houses for breeding purposes, and always building near the ground.

GREAT TITS.

The Long-tailed Tit makes a most elaborate nest, dome-shaped like that of the Wren, but outwardly composed chiefly of grey lichen, felted together with moss and cobwebs, and in-

BLUE TIT FEEDING ON A SUSPENDED NUT-KERNEL.

variably lined thickly with feathers—a cosy nursery for the second smallest of British birds. The numerous family keep together with their parents until the following spring, roving about meanwhile far from their early home. A very pretty sight it is to watch their undulating tandem flights from tree to tree, uttering meanwhile their sweet soft call-notes, "zit-zit." It has been suggested that their curiously elongated tail is of use as a balancing pole whilst searching wind-tossed tree-tops for insect food, but it must be much in the way during the fortnight of incubation, in which both sexes take part.

MARSH TIT AND NESTING SITE.

Length of tail is likewise a distinguishing feature of the Wagtail family, of which we have three forms that must be mentioned as of more or less frequent occurrence: the partly resident and widely distributed Pied or Common Wagtail; the Yellow, which is a summer migrant; and the rarer and more local, longer-tailed, more variously coloured and most elegantly formed Grey Wagtail. A distinguishing feature of this graceful family is that when on the ground they walk sedately, instead of hopping as the generality of small birds; they run nimbly and stop as suddenly, when the specific tail-wagging, or rather see-sawing, is complacently indulged in. In summer some few White Wagtails visit us, and may easily be mistaken for our common form; the chief distinguishing marks are that the back and wings of the latter are greyer, and there is more white on head and neck. It has a well-defined black hood, and the white on the cheeks sharply separates the black on the head from that on throat and breast. In winter the two species are not so clearly differentiated, and the young in both species have the cheeks and throat tinged with yellow.

All the family specially frequent the neighbourhood of water, but the Pied is the most ubiquitous and least fastidious in this respect, and may frequently be observed upon freshly ploughed fields in comparatively dry districts. The Yellow Wagtail chiefly confines itself to marshy localities, and the Grey to mountainous districts and running streams. The lovely blending of the bluish-grey upper parts, black garget, bright yellow under parts, white-edged tail and wings, render it one of the most beautiful of British birds.

The cinematograph has already lent aid to ornithology, one of the Messrs. Kearton's films bearing witness to the relationship existing between the Wagtails and Pipits by portraying a Meadow Pipit in the act of tail-wagging. Both name and note will assist us in distinguishing this bird of pasture and uncultivated land from the two other less

GREY WAGTAIL ON NEST.

widely distributed representatives of the genus; for although the feeble song and complaining, mournful call-notes, "peep, peep," of both Meadow and Rock Pipit are somewhat similar, the latter bird never leaves the coast, although it may be found on muddy as well as on rocky shores. The Tree Pipit is a regular summer migrant, and has a pretty song. It frequents the outskirts of woodlands for preference, and may

LONG-TAILED TIT AND NEST.

be identified by Yarrell's oft-quoted description: "He sometimes sings while sitting on the top of a bush or one of the upper branches of a tall tree; but most generally, starting from such a perch, he will be seen to ascend on quivering wings about as high again as the tree; then, steadying his wings, expanding his tail, and letting his legs hang straight down, he descends slowly by a half-circle, singing the whole time, to the same branch, or to the top of some other tree near by, without ever alighting on the ground mean-

while. So constant is this habit with him, that if the observer does not approach too near to alarm him the

PIED WAGTAIL.

bird may be seen to perform this same evolution twenty times in half an hour, and it is most frequently witnessed during and after a warm May or June shower."

This habit will at once distinguish him from the somewhat smaller Meadow and somewhat larger Rock Pipit. All three are sombre clad, genteel, Sparrow-like birds. The general brown plumage of the Rock Pipit is relieved by a shade of olive, and the breast spots are more conspicuous than those of the Meadow

TREE PIPIT ON NEST.

Pipit, and the similarity of the Tree Pipit to a diminutive and alert Song Thrush has frequently struck me. All three species nest on the ground, and their alternative title of Titlarks proclaims their affinity and proportion in size to the true Larks—a family of birds with which they share a beautiful adaptation of footgear, in that in those species which frequent grass land, and spend most of their time on the ground, the hind claw is greatly prolonged, enabling them to walk with ease upon a dense carpet of vegetation; whilst in the Tree Pipit the hind claw is curved, to suit its arboreal propensities, though not to so great an extent as is the case with the Rock Pipit. The latter bird has two dull-white alar bars, and the outer feathers do not show distinctly

MEADOW PIPIT.

white in flight, as is to some extent the case with the Tree Pipit, but most conspicuously in the Meadow Pipit. Some of these minor differences in such small birds may be difficult to discern whilst the subjects are at large, but field-glasses are so easily available and so very useful, that no student of wild-life should travel without them.

With the Pipits we have reached the end of the first tribe of the Passerine —Sparrow-like, or perching birds, to which Linnæus gave the name of *Dentirostres*, because they have the upper mandible more or less distinctly notched on each side. With the closely allied Larks, we commence the second Passerine tribe of *Conirostres*, or hard-billed birds, their stronger and more cone-shaped mandibles lacking the tooth-like beak

indentation, but they retain the straight hind-toe claw of the Pipits, and the sexual plumage does not vary. Though more strictly vegetarian than the Pipits, the Larks, in common with nearly all the smaller birds, feed their young chiefly on insects. The Lark is the only bird that I have ever seen taking a Garden White butterfly — perhaps it was a young bird that had yet to learn the warning intention of conspicuous coloration. The well-known song of the Skylark, though generally delivered whilst soaring, is sometimes uttered, in shortened form, from the ground; and although the habit is not frequent, I have more than once seen a Lark perched on a closely-cut hedge, and have timed the spirally sung song as lasting for over four minutes.

SKYLARK.

The resident but local Wood Lark, best described as a small Skylark with short tail and curved hind claw, sings whilst it hangs poised in the air. Skylarks often rise and fall perpendicularly as they sing, whilst the Meadow and Tree Pipits

SKYLARK FEEDING HER YOUNG.

rise and fall in large curves singing only as they descend.

The Wood Lark is silent usually after mid-summer as are also Thrush, Blackbird and Willow Wren, but the cessation of song cannot be presumed upon as a certain aid to identification, for it is a constant accompaniment to nesting, and if by any means the first attempt at breeding comes to naught, the season of song is then prolonged, and many birds that have been silent previously for some weeks sing again with subdued and shortened notes in early autumn.

Early morning is the most likely time for hearing the first spring notes of most species, and it is then that the song is generally most prolonged. At 4.50 a.m. on April 26th, 1908, I counted the welcome "Cuckoo" 87 times without intermission, and at 6.45 a.m. on June 24th, 1885, no fewer than 227 times!

MAURICE C. H. BIRD.

HOW TO KNOW THE CLOUDS

By WILLIAM J. S. LOCKYER, M.A., Ph.D., F.R.A.S.

With Photographs by the Author

III

IF the reader will look back at the cloud classification scheme he will see that we have now arrived at the heading "clouds of ascending currents," and under it two forms of clouds are mentioned—namely, *cumulus* and *cumulo-nimbus*. The reason why these two types are put in a class by themselves is that they owe their origin to the daily heating of the land by the sun, and the consequent warming and rising up of the air to higher levels. When this warm moist air reaches altitudes in which it can no longer maintain its moisture in the invisible form, the vapour becomes apparent in the form of a cumulus cloud. On this account cumulus clouds are more common in summer than in winter, and at midday more often than in the early morning and late evening.

The reader will have no difficulty in differentiating a cumulus type of cloud from other types. Briefly, it may be described as a thick cloud, the upper portion of which is dome-shaped, or sometimes, when the cloud is large, like a cauliflower, and exhibits protuberances, while its base is usually horizontal.

"If woolly fleeces spread the Heavenly way,
Be sure no rain disturbs the summer day."

The photograph on the opposite page illustrates these small woolly cumuli, which are often seen sailing along above or past us during the summer months.

This photograph was taken at Tunbridge Wells on May 18th, 1907, at 10.15 a.m., the camera being pointed nearly due west. When such clouds pass before the sun they appear very dark with brilliant edges, and sometimes when they are not too thick they present a fine spectacle.

It is on these occasions that one sometimes sees the very pretty effect of solar beams being shot out from behind the dark cloud. These shafts of light are, of course, only the interspaces between the shadows of the irregular portions of the cloud which are cast on the air; on some days they are rendered far more prominent than on others, but this may probably depend on some particular condition of the atmosphere. It is an old idea that the appearance of these rays indicates coming rain, as the following, out of many old sayings, will show:

"The sun is getting up his back stays,
And it is time to look out for bad weather."

Perhaps, as the rays are only formed when low clouds pass across the sun,

and these are generally cumulo-nimbi or cumuli, the deduction is somewhat logical. Most picturesque photographs of these rays and clouds can be easily secured, but lack of space prevents one from being reproduced here.

type. The cumulo-nimbus is always associated with rain or snow or hail.

In the lower illustration on page 118 the shower cloud form of cumulo-nimbus is illustrated. The shower cloud is usually somewhat larger than the ordinary sum-

CUMULUS CLOUDS.
From a Photograph taken at Tunbridge Wells, May 18th, 1907, at 10.15 a.m.

On some days cumuli appear as if partially broken up by strong winds, the detached portions undergoing continual changes. They are then termed *fracto-cumuli*. An example of this type is shown on page 118, which is from a photograph taken at South Kensington.

We now come to another form of cumulus, termed *cumulo-nimbus*. This is the thunder or shower cloud. It consists of heavy masses of clouds towering up in the form of mountains, turrets, or anvils. They are generally accompanied by a sheet of thin, streaky cloud above them, termed " false cirrus," while underneath is a mass of cloud of the nimbus mer cumulus, but much smaller than the thunder cloud. The well-known saying:

" A round-topped cloud, with flattened base,
Carries rainfall in its face,"

very well describes this type of cloud and its rainy character. The particular one here shown dropped rain heavily as it passed over the position of the camera, thus proving its nimbus character; while its dome-shaped top renders it a cumulo-nimbus. The photograph was taken at Tunbridge Wells on May 18th, 1907, at 11 o'clock.

The next illustration will give the reader some idea of the enormous dimen-

FRACTO-CUMULI CLOUDS.

CUMULO-NIMBUS CLOUD.
This is a shower cloud and comparatively small.

sions to which cumulus clouds attain, but he must remember that the cloud in question was a great distance off. This cloud had the appearance of being of the cumulo-nimbus type, although one base of a cumulo-nimbus may be about 4,700 feet from the ground, its apex or top may extend to an altitude of about 26,000 feet; the vertical thickness of such a cloud measures then approximately

CUMULO-NIMBUS CLOUD.
Photographed at a great distance, and is therefore of very large dimensions.

could not be certain, as it did not pass overhead.

It was possibly in the initial stage of becoming a thunder cloud, although it had not then begun to flatten out at the top and assume the anvil form, the general feature of thunder clouds. The photograph from which this reproduction has been made was taken at South Kensington in 1906 on May 25 at 9.30 in the morning.

The great heights to which thunder clouds can attain may be gathered from the fact that they sometimes reach the level of the upper clouds, the average heights of which are about 29,500 feet. Measurements have shown that while the 21,500 feet. When we remember that Mount Everest, the highest mountain in the world, rises 29,000 feet from sea level, some idea of the magnitude of these clouds may be grasped.

It sometimes happens that the under surface of a cumulo-nimbus presents a mammillated appearance—that is, droops downwards, like a festoon of drapery. When this is the case it is termed *mammato-* or *festooned-cumulus*. This peculiar feature does not seem to be of common occurrence in this country, and I have only noticed it on two occasions. Fortunately, on one of these, May 21st, 1906, at 1.30 p.m., the camera was available, but the feature was somewhat less pro-

nounced when the photograph was taken. The reproduction on this page will serve to render some idea of the peculiar appearance of the cloud.

We come now to the last type of cloud —namely, the *stratus*, a form with which we are all very familiar, it being nothing more than an ordinary fog lifted up from the ground. Sometimes it is broken here and there by the wind, and exposes the blue sky overhead, or the summits of mountains penetrate it. On these occasions it may be distinguished by the name of *fracto-stratus* to differentiate it from the unbroken sheet.

Those who live in hilly districts can often tell successfully the kind of weather that will prevail by close observation of the behaviour of these low clouds. When hill-tops are shrouded in mist, this is nearly always a sign of rain, and innumerable old sayings, such as :

"When Cheviot ye see put on his cap,
Of rain ye'll have a wee bit drap,"

tell us that this is very generally known.

One other old weather-lore saying is well worth quoting here, for it shows that the rhyme must have been based on both accurate and long-continued observation:

"Mists dispersing on the plain
Scatter away the clouds and rain;
But when they rise to the mountain tops,
They'll soon descend in copious drops."

In bringing this article to a close the writer hopes that even if he has not imbued the reader with enthusiasm for the study of cloud-land, he will nevertheless have wakened in him an interest to observe more closely the sky overhead. Many a half-hour can be pleasantly spent by watching the happenings in the upper air, and the more familiar one becomes with such the more one is fascinated and drawn to make a closer study of them.

"Thus when the changeful temper of the skies,
The rare condenses, the dense rarifies,
New motions on the altered air imprest
New images and passions fill the breast;
Then the glad birds in tender concert join,
Then croaks the exulting rook, and sport the
lusty kine." *Virgil's "Georgics."*

WILLIAM J. S. LOCKYER.

MAMMATO- OR FESTOONED-CUMULUS CLOUD.

SHAKESPEARE'S GARDEN, STRATFORD-ON-AVON.
From the Water-Colour Drawing by A. C. Wyatt.

Photograph by Pictorial Agency.

ROSES IN F.-M. VISCOUNT WOLSELEY'S GARDEN.
(From the Hon. Frances Wolseley's "Gardening for Women")

ROSES AND ROSE GARDENS

By H. H. THOMAS

TO write of roses and rose gardens is to write of every garden in every country, for how could a garden *be* a garden without its rose beds and bowers, its arches and arbours, poles, pillars and pergolas? It would be as a flower without fragrance, as a jewel without its setting. There is no flower comparable to the rose in beauty and variety of form, in grace and charm, and — more important still — in adaptation to all sorts of conditions in widely differing gardens. There is not a wall, whether it face north, south, east or west, that may not hide its barrenness beneath a screen of fairest rose blossom, no plot, however small or smoke-begrimed, in which some rose will not flourish. By its indifference to environment, it has become the idol of the people, a flower as deeply loved as it is widely grown. There is no garden so lowly that the rose will leave it unadorned, if (ah! what issues lie upon an "if"!) there be great tenderness in the tending, in the greeting a warm affection whose ardour does not cool as time flies by. For with all its indifference to vulgar show and elaborate display, the rose was never a flower to outstay its welcome. There must be love, deep, lasting love in the gardener's heart if he would coax the queen of flowers to the pinnacle of her greatness. Then other things matter little.

Photograph by F. Mason Good, Winchfield.
ENTRANCE TO ROSE GARDEN, ESHER.

Take a lesson from the roses that throng the hedgerows of our countryside, that climb the forest trees of exotic lands, and see how Nature tends them. First and best of all she gives them fair depth of soil in which the roots may find a happy home, shelter for the tender shoots that thrust their reddening noses through the ground as spring comes round, and finally sunshine for the lissom growths that twine and climb and bear their load of glorious blossom. Can Merrie England show a fairer sight in the leafy month of June than Dog Roses clambering about the wayside hedges, binding them with wreaths of graceful bloom, the slender shoots bending almost to breaking point, as flower and fragrance-laden they sway in the faintest breeze that blows? Surely there is none. The man whose heart-strings are so attuned that they cannot respond to the entrancing beauty of a rose-embowered hedge, must surely have lost all joy of living. A day among the wild roses is a tonic for the mind and brings a glow of gladness to the soul.

How bounteous, how prodigal is the profusion of Nature's own wild flowers! How she cares for them and how they respond! And why? Simply because they are the right flowers in the right place. And why do the masses of common hedgerow Dog Rose appeal to the hearts of every one of us, for the moment touching all that is best in our warped and crooked nature? Because of their naturalness, their simplicity; because in their company we get, for a time, nearer to that ideal towards which, consciously or unconsciously, all of us incline—close to the heart of Nature.

And what of rose gardens? A rose garden should be a home of roses, where, under due restriction, each kind may go its own wild way: only thus is it possible to have a garden of roses. For strange anomaly though it may seem, a rose garden is not necessarily a garden of roses. First of all there should be roses that clamber and climb, that cling with loving clasp, hiding bare walls and barren fences, dead trees and rustic poles beneath a fair canopy of blossom. These are essential to the making of a garden of roses. There must be roses new and roses old, roses common and roses rare, English roses and roses from unfamiliar lands, all growing in friendly rivalry, each striving to surpass the other at blooming-time. But most and best of all there would be fragrant roses, whose scents, commingling in the evening air, transform the garden into a place of real delight,

in which to dream glad dreams, and in moments stolen from the workaday world, feel the enchanting glamour of the land where the roses grow.

> "Everywhere are roses, roses,
> Here a-blow and there a-bud,
> Here in pairs and there in posies,"

should be the gardener's motto, so that at flowering-time the shoots might bend beneath their load of summer snow, and cover the ground with a carpet of flaky blossom as the roses fade.

What great variety is found among roses that climb and creep! From the Japanese rose that makes slender growths, 20 ft. long, in one season to be studded with pink or white flowers the next, to the magnificent crimson of Reine Olga de Wurtemburg that flaunts her queenly petals to the summer sun, there is a vast motley of roses in red and white, pink, crimson and yellow, and shades of those impossible to describe and baffling the artist's brush to portray. Some there are that surpass all others in one magnificent display in full summer time, while others, wiser perhaps in their generation, give less generously of their beauty then, but with equal generosity again in early autumn. An ideal garden of roses possesses both. Among those that give their all at the early flowering, not any are more prodigal than the Crimson Rambler, whose brilliant bloom masses are thrown into bold relief by the setting of bright green leaves, and Dorothy Perkins, which shows a rose pink haze of blossom shimmering against the cerulean blue like a sunset, sun-stained cloud. But, after all, such as these form only the frame to the picture, yet even as the fine effect of a painting depends to some extent upon its frame, so the rose garden, which is influenced in greater degree by its environment, needs to be placed amid harmonious surroundings. There are none more fitting than those formed by roses that clamber and ramble and climb, imbued with the spirit of joyous life.

Within there are roses in bewildering variety, many old-fashioned and some forgotten—Monthly roses, Cabbage roses, York and Lancaster, Moss and Provence, Sweetbriar, Damask, Maiden's Blush, and others now seldom seen. Yet no rose garden worthy of its name can be without them, for none sweeter ever blossomed, and a rose without fragrance is a rose undone. Sooner or later it must fall into irretrievable oblivion.

Photograph by F. Mason Good, Winchfield.

BLUSH RAMBLER.

Fragrance is the very soul of a garden of roses; the breath of its life; wanting in sweet perfume it is an outcast from Flora's realm, without charm and disenchanting. Most delightful time of all and leaves. Gloaming in the garden of roses is counted as one of the supreme joys of days and hours in a garden; there is, perhaps, none comparable to it. It is then that the roses charm as never

MR. TATE'S ROSE GARDEN AT DOWNSIDE, LEATHERHEAD.

in the rose garden is when the shadows lengthen, when evening falls and the still air is heavy with the subtle scents of flowers, with rich aroma from the Cabbage rose (plebeian only in name), full fragrance from the Monthlies and Damask, and the scent, delicate yet distinct above all others, of the Tea rose. Then is the garden of roses a place that conjures dreams with power to solace and please. Is is as though at the whisper of the flowers a fairy wand had worked a magic change; the fragrance-laden air soothes dull care away, the roses' lips are wet with the kiss of dew and gleam like jewels as evening falls to dusk, and the moonbeam's silvered glow lights up the flowers they charmed in the sunlight's glare and glitter.

It is a far cry from the old-fashioned roses of half a century ago to those that depend for their attractiveness on rich colour and perfect form rather than fragrance. Is it possible that the rose gardens of the future shall be bowers of scent and arbours of subtle perfume no more? The gods forbid! Yet many of the new roses of the twentieth century appeal, not by the enchanting scent that has been characteristic of roses and rose gardens from all time, but by their surpassingly beautiful colours and shades of colours, poise and form of petal, perfect to the artificial standard of the florist.

Among rose exhibitors such things may pass, but then the gardens of those who grow roses for exhibition are often an example of the truth of the saying that "rose gardens are not necessarily gardens of roses." In the rose rich colour and perfect form can never make up for loss of fragrance. However effectually a scentless mass of bloom may appeal to the eye it awakens no response in the most acute of all senses, the sense of smell. It compels an appreciation that is born of the lips and not of the heart. Alas! for the rose of which this can be

Photograph by F. Mason Good, Winchfield.

"ROSES THAT CLAMBER AND RAMBLE AND CLIMB."

said, it will never play its part in the making of a garden of roses. It may win prizes in the exhibition tent, command praise for its shape and shades of colour, but it cannot give pleasure to those who recognise in the rose the very spirit of fragrance, the emblem of a scented flower. Surely the old roses have taken too deep a hold in our hearts to be compelled to give way to usurpers that would boldly curry favour, wanting in the attribute that has raised the rose to the proud position of queen of flowers. Doubtless, however, there is room for all.

"Times change and we with them." The favourite of yesterday is neglected to-day, and to-morrow forgotten.

We owe one debt of gratitude to the newer roses, a debt so great that possibly it compensates for the loss of fragrance in some of them. The fault of the old-fashioned roses, "grandmother's roses" as they have been called, is that they give such a fleeting display of bloom. For two weeks or three they make the garden gay, and then, alas! it is a long, long, weary wait until summer comes again and the roses bloom anew. The newer roses have changed all this; it is now an easy matter to have roses from May until December. On a warm and cosy wall in the merry month of May the old favourite Gloire de Dijon may be induced to bud and blossom, and a little later Queen Marie Henriette, her petals robed in carmine red, keeps company. The China roses then take up the running, to be followed quickly by an unrivalled pageant throughout the summer months, while autumn's first touch serves but to awaken to fresh beauty many of the newer sorts of Teas and Hybrid Teas. Workers among the flowers have made autumn in the garden far more delightful than ever before—a time to anticipate with joy rather than to view with regret. Now roses form a bridge of blossom over the gulf dividing summer from winter, bringing fragrance to the chill air, rich colour to the dull, wan days. None perhaps is more prolific of autumn bloom than a proved garden favourite, Caroline Testout, whose large, bright pink, shell-like petals kindle a warm glow in the drab and deepening gloom.

How varied are the forms in which roses may be grown. There are standards and half standards, climbing roses, roses that ramble and roses that creep, as well as dwarf or bush roses. Standard roses belong almost to a generation that is past. It would seem as though the secret of their cultivation was disappearing with the gradual passing away of the old English cottage garden, for it is there to-day that one must seek for the finest standard roses. Probably the explanation lies in the fact that the roses which make the best standards, are some of those old-fashioned sorts still exclusively grown in little country gardens. For there are some roses that will and some that will not grow well in standard form. In gardens of more elaborate pretensions all sorts of roses have been grown as standards with the result that many have failed ignominiously, and the standard has fallen into disrepute. Probably, however, cultivation is not altogether to blame, for a gardener alone cannot make a garden. The rose garden must grow slowly under the fostering care of time, that crude effects may be touched to subtle harmonies, gaudy colours to restful tones. There is something about the cottager's roses that compels the acknowledgment of the presence of some strange and satisfying influence. It is a sense of harmony, of subtle association with environment; the flowers have so grown up with the garden as to form an inseparable part of one harmonious whole. The cottager having planted the baby rose leaves it to grow up as the garden grows old, that time may weld them both in a bond of peace.

H. H. THOMAS.

HOW TO KNOW THE INSECTS

By JOHN J. WARD

Author of "Some Nature Biographies," "Peeps into Nature's Ways," etc.

Illustrated from Original Photographs by the Author

THE COMING OF SUMMER

WHEN summer has really arrived, the amateur Nature student, who has been diligently striving to know the insect world, often begins to feel that his task has become a hopeless one, and he is tempted to give up in sheer despair. For some weeks past his insect friends have daily become more numerous. Early in the season there was difficulty in finding specimens; now they are by far too obvious and too numerous. So many and such varied species have appeared that to attempt to learn their ways and to understand them seems beyond possibility. In the hot sunlight their buzzing fills the air; the herbage is crowded with their tiny quaint forms, and it is only necessary to shake the branches of the larger trees to discover that they also harbour great swarms. By the waterside still other forms appear, and a glance into the water will show that even there they are also largely in evidence. These small people of the natural world have, indeed, been so successful in the struggle for existence that they now can hold their own in practically every life-sphere that the earth provides; in fact, they often go further, and so establish themselves over vast tracts of land that even man's dominion there is overthrown, and he is driven away before their onslaught. Seeing, then, how abundant insects are, those who study their ways have to be content with considering a few species only at a time, leaving the many for subsequent investigation.

WHITE ADMIRAL BUTTERFLY.

In the present article, therefore, I am making no attempt to enumerate the vast and varied throngs of beetles, flies, bees, ants, wasps, moths, butterflies, etc., that appear in such abundance during the summer period. Instead, I propose to continue with the developments of some of the insects previously considered and introduce new insects of other types from time to time as these developments are completed.

One of the butterflies shown in its preliminary stages in my last paper has now

completed its development. That quaint, spiny caterpillar which suspended itself to the branch and changed into a chrysalis, has now again assumed a still more wonderful form. It has become a most charming butterfly with velvety brown and white wings above, while their under sides are coloured with delicate blue-greys contrasted with patches of mahogany brown. In the first illustration here, the insect is shown in all the glory of its handsome uniform. It is the White Admiral Butterfly (*Limenitis sibylla*). In this lovely guise the insect will probably spend some two or three weeks of life in the sunlight, swiftly flying along the woodland glades, seeking its mate, and then depositing its eggs about the leaves of honeysuckle bushes, with which operation its career will terminate. From its eggs will come little caterpillars, which feed on honeysuckle leaves until winter approaches, when they hibernate, wrapped in shrunken leaves, until spring. In the early spring they commence to feed again, and quickly develop into the spiny caterpillars that eventually suspend themselves to a branch by their tail-ends, prior to changing into chrysalides, as previously observed.

CATERPILLAR OF THE BRIMSTONE BUTTERFLY PREPARING TO BECOME A CHRYSALIS.

The second butterfly considered in my last paper was then, as we observed, in its caterpillar stage, and was feeding on buckthorn leaves. In the illustration on this page the full-grown caterpillar is shown preparing to become a chrysalis. It will be observed that its method of procedure is quite different from that of the White Admiral Caterpillar. This caterpillar of the Brimstone Butterfly does not hang head downwards, but becomes a chrysalis with its head pointed upwards. The next illustration shows this same caterpillar after it has moulted its skin and evolved into a chrysalis. Notice that the chrysalis is not only attached at its tail-end, but is also supported with a delicate silken girdle round the body. Now these contrasting features are important points in the classification of butterflies, for those butterflies which in their chrysalis stage are suspended by their tails produce butterflies of both sexes with only four perfect legs, the forelegs being rudimentary and of no use in walking; and on these features are based the characteristics of the extensive family of the *Nymphalidæ*, which include Fritil-

CHRYSALIS OF THE BRIMSTONE BUTTERFLY.

laries, Tortoise-shells, Admirals, Peacocks, Ringlets, Meadow-browns, Graylings, and other familiar butterflies. The Brimstone Butterfly belongs to the family known as *Papilionidæ*, in which the butterflies of both sexes possess six perfect legs, and the chrysalis is attached by its tail, but in an upright position, and girdled by a silken thread, as shown in the illustration. This family includes the Common Whites, Orange-tips, Clouded Yellows, Swallow-tails, and the Brimstones, as we have seen. So that by studying the metamorphoses of the White Admiral and Brimstone butterflies we get a clear exposition of the salient characteristics of two of the largest families into which butterflies are grouped.

The chrysalis stage continues for some sixteen or seventeen days before the butterfly is ready to appear. In my next paper I hope to be able to introduce a photograph of it before it enters on its final sphere of life and seeks to conquer space on its pale yellow wings.

We may now look for further development from those cocoons at which we glanced at the end of May. From the cocoons amongst the coarse grasses will shortly emerge Drinker Moths, and these may somewhat astonish the amateur entomologist by their variety of colour. Some are of a tawny brown, while others are almost a golden yellow, and two white spots, one large and one small, appear near the centre of the forewings. The individual insects vary very much in colour, but there is a distinct division into brown and yellow insects, and the brown insects, it should be observed, have large and feathery antennæ, as illustrated in the upper example on this page, which is a photograph of the male moth. Below is the yellow female insect, whose antennæ are comparatively simple in structure. Light has great attraction for these moths, and they may frequently be found on the outskirts of towns fluttering somewhat recklessly around street lamps, often finding their way into the interior of the lamp, where they meet their doom.

Wherein lies the mysterious attraction in artificial light that so fascinates moths and other insects it is difficult to imagine. Undoubtedly the light appeals to some sense of the insects, and often so forcibly as to make them oblivious of everything around them. Some of the larger Hawk-Moths are so reckless in the presence of a bright light that I have frequently seen them plunge at the globe of an electric arc-light with such force that the impact caused a distinctly audible thud and hurled them stunned and helpless to the ground. It is a remarkable fact that while to some moths light seems irresistible, others are never attracted by it. Considered by analogy with our human senses, this attraction seems unaccountable, but I am inclined to think that it must be something akin to that fascination which a large flywheel of an engine exerts,

DRINKER MOTHS.
The upper is the male insect.

SWALLOW-TAIL MOTH.

when revolving, upon some people, or the similar fascination which water continually rippled by wavelets exercises. To the moths our artificial lights may appear as rushing or whirling objects of this nature, which first attract their interest, and then, exerting an ever-increasing allurement, at last become irresistible and draw them into the vortex. Just as there are human beings who can coolly face a rapidly whirling wheel, while others must turn from it or lose control of themselves, so it may be that some insects are quite immune to such fascination while others cannot resist it. This fascination which light exerts for moths is sure to be observed by the amateur naturalist, and he will naturally ask the "Why?" of it. As I have never yet met with any plausible explanation of this phenomenon, I offer the above as a suggestion.

There is no moth that is more likely to be seen visiting the lights than the Swallow-tail, whose stick-like caterpillar and leafy cocoon we have previously considered. In the year 1902 these insects were more than usually abundant, and throughout the month of July of that year the electric arc-lights of the town (Coventry) in which I was living were a sight well worth witnessing. The moths were so abundant as to give the effect of a snowstorm as they fluttered around the lights. The pale primrose yellow of their wings appeared white in the electric light, and their gentle, fluttering flight gave the effect of falling snowflakes; although, of course, flakes of an unusually large size, for their wings sometimes extend two and a half inches. The Swallow-tail is one of the commonest of moths during July. Each female moth deposits

CATERPILLARS OF THE BLACK ARCHES MOTH.

about five hundred eggs, usually amongst the leaves of elder, honeysuckle, or fruit trees; and I need hardly add that each of these eggs, if all goes well, gives birth to a little caterpillar which every day grows more and more stick-like, until its mimicry is as perfect as those examples illustrated in my first paper.

By shaking the branches of oak trees during July some of the curious larvæ shown on p. 130 may be met with. These caterpillars possess conspicuous coloured patches and tubercles bearing tufts of blue and red hairs; in fact, the larvæ appear as a mixture of colours —yellow, red, blue, green, brown, grey, and black. This is the caterpillar of the Black Arches Moth (*Psilura monacha*), and it probably represents an instance of "warning colours," its striking livery indicating to its enemies that it is unpleasant to the taste. There are many instances of larvæ, and even fully developed insects, which develop colours that make them conspicuous, as a means of protection. This method of protection, of course, is a complete contrast to that of the stick-like caterpillars and other insects which mimic their surroundings to escape the eyes of their foes.

Now is the time when Dragon-flies begin to be conspicuous, especially the larger kinds. On this page is shown one of the largest and swiftest-flying of these insects amongst British species—a member of the family *Æschnidæ*. A few minutes before I photographed this insect it was hawking for small flies and midges up and down a country lane, keeping more or less to a particular stretch of the lane, and every now and again coming to rest on a branch of blackberries, as shown in the photograph. Probably it was then digesting the mouthful of flies it had captured. The flight of these insects is very powerful; they reverse their direction with remarkable facility, even when travelling at full speed. Their appetite is enormous, and their prey is captured while they and their victims are on the wing. I once saw a Dragon-fly bite quite a large piece from the wings of a White Cabbage Butterfly and immediately munch it up. This may seem an extraordinary occurrence to witness, but it so happened that I and the Dragon-fly were both after the same butterfly, for after striking at the butterfly with my net, I discovered that I had captured a Dragon-fly as well as the butterfly, and also that the Dragon-fly had captured the butterfly.

DRAGON-FLY.

Their speed of flight, bright colours, and gauzy wings contrast greatly with their earlier stages, when they live as crawling larvæ at the muddy bottom of a pond. These larger species, on account of their powers of flight, often travel to woods and country lanes at long distances from the place of their birth to seek their prey. I have frequently seen them in towns hawking under trees; in fact,

they are such ravenous feeders that they will occasionally enter houses while hunting flies. When this event does happen, and often when it does not, the Dragon-fly may come to grief, for these insects have by some means acquired an evil reputation. In Scotland they are "flying adders"; in some parts of England "horse-stingers"; and in other parts "devil's darning needles"; while in the Midlands they are generally called "hornets" (which are, of course, entirely different insects). Even the name "Dragon-fly" is not an inviting one, and savours of superstition. These insects, however, do not possess a sting, although when captured they brandish the tail-end of their abdomen in a manner that seems to imply mischief. Nevertheless, they are quite harmless; and I need scarcely add that, although they may bite through a butterfly's wings, yet their mouth parts are not sufficiently strong to injure the human skin.

JOHN J. WARD.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.
Author of "Wee Tim'rous Beasties," etc.

THE RED-BACKED MEADOW MOUSE

BANK VOLE. RED VOLE. WOOD VOLE.

With Photographs by the Author

I FEEL that I need make no apology for reviving a term so direct, elegant, and descriptive as *Meadow Mouse*, and employing it in preference to a term so uncertain, ugly, and meaningless as *Vole*.

The objections to the latter have been ably summarised by Mr. Lydekker, who has laid especial emphasis on its arbitrary museum origin, and on its complete absence from the vernacular. To these objections I would add the additional one (founded on long experience) that, in the rustic mind, it is invariably and not unnaturally confused with *Mole*.

It has been suggested to me that "Water Vole" in place of "Water Rat" may serve a useful purpose in emphasising the distinction between a harmless, attractive animal, and another animal (the common Rat) whose characteristics are the reverse of harmless and attractive. I must confess, however, that I have never yet heard the term naturally employed in speech, though it may occasionally intrude itself as a learned correction; and I fear that the slayer of rats (an impetuous, choleric man) strikes first and identifies at leisure: "How now! A rat? Dead for a ducat! Dead!"

The addition of the Red-backed Meadow Mouse to the list of British fauna is comparatively recent, and the credit is due to Yarrell, who wrote of it in 1832. That it should not have been recognised previously may be attributed to the scant attention which animals, as opposed to birds, fishes, and insects, have received from British naturalists. This want of interest appears to have been persistent, for it is only within quite recent years that the occurrence of this species in a fresh locality ceased to be ceremoniously recorded in the Natural History papers. There is little doubt that the Red-backed Meadow Mouse is universally distributed throughout Great Britain; and in some parts of the country—I may instance the particular district of West Kent in which I live—it is extremely common. From the fact that its remains have been discovered both in the Caves and in the Norfolk Forest Bed—its teeth can be certainly identified—we may assume that it has been indigenous for an indefinite period.

THE RED-BACKED MEADOW MOUSE.
The side view gives some idea of the approximation to the True Mouse type.

It must be admitted, however, that the Red-backed Meadow Mouse presents a somewhat indeterminate appearance owing to his resemblance, on the one hand to the True Mouse type, and on the other hand to the Meadow Mouse type. In many respects he forms a connecting link between them, and this, no doubt, has frequently led to his confusion with one or the other.

His resemblance to the former (to a Long-tailed Field Mouse, for example) may be seen in his comparatively sharp muzzle, in his outstanding ears, in his estimable length of tail, and in his wiry, clean-cut limbs. His habits accord pretty closely with his appearance. He is a bold, hardy, active Mouse, who shows a decided preference for made ground in the neighbourhood of human habitations, who is prompt to take advantage of winter sunshine, who can climb and jump and run with the best, and who will show his natural audacity by the careless fashion in which he enters a trap, and by the devil-may-care air which he adopts in captivity. I have caught the same individual seventeen times in two days, and he showed no hesitation in leaving the trap for my hand, and jumping to ground from the end of my outstretched arm. I have often released them on to a branch in the hedgerow, in which case they usually perform their toilet, and take a meal off the leaves, before descending to earth. Different individuals show different degrees of boldness; but as a rule, like the Long-tailed Field Mouse, and unlike the Short-tailed Meadow Mouse, they are easily tamed.

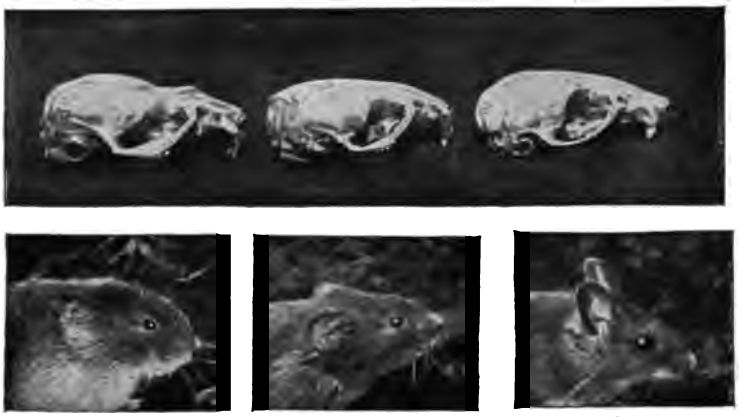
Apart from these external features, there are certain peculiarities of the skull in which the Red-backed Meadow Mouse closely approaches the True Mouse type.

For the proper appreciation of these, and of the influence which they seem to have on his diet, it will be necessary to refer briefly to mouse-skulls in general.

If the reader will pass a finger from the outer corner of his eye towards the opening of his ear, he will feel a ridge of bone which curves out perceptibly from the side of his head. This is called the zygomatic arch. In many animals, owing to the prominence of the face-portion of the head at the expense of the brain-portion, the zygomatic arch forms a remarkable feature of the skull, and when, as is the

THE RED-BACKED MEADOW MOUSE.

case with mice, the hollow of the eye is hardly distinguishable from the hollow of the temple, and both lie back within the circuit of the zygomatic arch, the solidity or otherwise of the latter is of considerable importance in determining, so far as outward inspection can go, the solidity or otherwise of the skull itself.



HEADS OF THE SHORT-TAILED MEADOW MOUSE (1); RED-BACKED MEADOW MOUSE (2); AND LONG-TAILED FIELD MOUSE (3).
The shape of the zygomatic arch is a reliable guide in distinguishing the three species.

In the Long-tailed Field Mouse the zygomatic arch describes a gentle sweeping curve, with no thickening of the middle portion, and but a slight angularity at the hinder end. In the Short-tailed Meadow Mouse the arch presents abrupt, strong-looking angles, and a stout, flattened joint in the centre where two of the bones composing it overlap. In the Red-backed Meadow Mouse there is a midway development both of the joint and of the angularity.

The lower jaws of the three species afford a similar scale of comparison: in the Long-tailed Field Mouse graceful lines, in the Short-tailed Meadow Mouse solid ridges, and in the Red-backed Meadow Mouse a mean between the two.

The teeth of the three correspond with their several settings. It will be convenient to leave the grinding teeth of Meadow Mice, and the extremely beautiful patterns which their grinding surfaces present, for consideration in a subsequent article, and to confine ourselves for the moment to their incisors or cutting teeth.

The incisors (front teeth) of Rodents present such unique characteristics that it is possible to distinguish a member of the order by them alone.

They are large, strong, curving teeth, often of a yellowish or orange colour, which grow continuously during the animal's lifetime. The working part is composed of the usual ivory and enamel; but the enamel, instead of covering the whole exposed portion, is almost if not entirely confined to the outer surface. Owing to its hardness it wears away more slowly than the ivory behind it, and the result is the formation of a chisel edge, and its maintenance in a sharp condition by wear and growth combined.

Both upper and lower incisors grow in regular curves, and, should one be accidentally broken, the opposing tooth, above or below as the case may be, continues its curve, and grows back upon itself, with disastrous and often fatal results to the animal.

The upper incisors being situated in the fixed upper jaw are, of course, immovable. In gnawing, the work is effected mainly by the lower incisors; and the lower jaw, while admitting of movement in several directions, is specially modified for back-and-forward chiselling. To this end the hinder portions of it are lengthened, giving additional scope for the lengthening and contraction of the masseter muscles, which are attached to the fore-parts of the animal's face and do most of the work in pulling the lower jaw forward. Moreover, the portions of the skull to which the lower jaw hinges are grooved to assist a back-and-forward motion.

One would expect to find that teeth which acted as chisels, and in which it was extremely important that the edges should wear evenly, would not admit of any side or cross movement such as would tend to blunt their edges on the edges of the teeth opposed to them.

CHARACTERISTIC ATTITUDES OF THE RED-BACKED MEADOW MOUSE

The bottom left-hand picture shows the Mouse burrowing.

In point of fact, however, the lower jaws and teeth of mice admit of considerable movement, both conjointly from one side to the other of the mouth, and separately, to varying distances from one another. They form a tool of which suppleness is a distinguishing feature. This tool, however, is singularly effective in chiselling all kinds of vegetable matter, and it is possible that its side and cross movements are an advantage to the mouse in dealing with fixed obstacles. It is noticeable in this connection that a wooden cage for rats or mice need not be metal lined throughout. It is only necessary to protect the right-angled junctions of the sides, top, and bottom, for the rat or mouse can get no grip on the flat with his upper incisors, and consequently cannot gnaw it.

1 2 3

LOWER JAWS OF LONG-TAILED FIELD MOUSE (1); RED-BACKED MEADOW MOUSE (2); AND SHORT-TAILED MEADOW MOUSE (3).

There are interesting variations in the form of the lower incisor teeth in the different species of mice. In the Long-tailed Field Mouse we find a tooth thicker (front to back) than it is wide, with a long, hollowed bevel—a carver's chisel, in fact; in the Red-backed Meadow Mouse a slightly wider tooth with similar bevel —a cabinet-maker's chisel; and in the Short-tailed Meadow Mouse a tooth whose width is about equal to its thickness, and whose bevel is short and abrupt—a carpenter's chisel. A long bevel and narrow cutting edge are an advantage in dealing with hard material, owing to the lesser substance of the shaving. It is not surprising, therefore, to find that the Red-backed Meadow Mouse is, like the Long-tailed Field Mouse, a confirmed nut-cracker; and that, where the bark of trees is attacked by mice, it is probably one of these two species which is the culprit.

In the spring of 1902 I excavated in a neighbour's orchard the local habitations of two small rodent communities. One was tenanted by Long-tailed Field Mice, the other by Red-backed Meadow Mice. They were situated within fifteen yards of each other, and appeared to be conducted on similar lines. In both cases there were, as far as I could determine in the intricacy of the roots, three entrances. In both cases these entrances terminated in a double compartment, sleeping-room and store, some eighteen inches below ground-level. In both cases the community consisted of five adults, and in both cases the store was entirely composed of cob-nuts. The Field Mice had ninety-eight, the Meadow Mice ninety-three, so tightly packed that it was difficult to dislodge them with the fingers. No doubt this was due to a gradual subsidence of the roof of the burrow, which the mice themselves would be quite capable of remedying. The nuts were intact, and I failed to discover any empty shells either in the burrows themselves or in their vicinity. This looked as if the stores had not yet been drawn upon, for the nuts were of excellent quality; and to those fond of the nuts I would recommend the expedient of maturing them at an even temperature as the mice do.

The presence of such large stores naturally roused my curiosity as to how the nuts were originally collected and handled. Experiments with captive Meadow Mice showed me that at least three methods of transport were employed. Their usual practice is to take the pointed end of the nut between their teeth and to jump along with their heads held high. Sometimes, however, they wedge it between their chin and fore-legs, and sometimes they trundle it before them.

Owing to the all-round effectiveness of his teeth and to his catholic taste in vegetables, the Red-backed Meadow Mouse can make his presence felt.

"Its fur is red as the red chestnut,
And it is blithe and slim;
It leads a life most innocent
Within the forest dim."

So sings the poet; but what sings the gardener? Ninety per cent. of the injury done in plantations and gardens by mice is the joint work of the Long-tailed Field

THE RED-BACKED MEADOW MOUSE CLEANING HIS TAIL.

Mouse and the Red-backed Meadow Mouse.

Both species prefer made ground, both species are prolific, and both species are voracious. It would be idle to attempt to enumerate the plants they have a liking for, and little that they fancy, either above ground or below, will escape them. To reach the first they clamber, to reach the second they burrow or drill. Moreover, being provident little beasts, they guard against contingencies of weather by making stores. Hence the small tell-tale heaps of earth from end to end of the pea-row.

Yet, even from the gardener's point of view, a few points may be urged in their favour. They are persistent consumers of moths, caterpillars, grubs, and snails, and in this respect undoubtedly do him service.

A passage quoted by Millais "from a gardening paper" pretends an even higher claim. It shows how hyacinths may be increased, and runs as follows :—

"The Dutch growers were helped out of the difficulty of rapid reproduction, like the captive lion of fabled history, by a mouse. It was observed that certain hyacinths here and there, instead of blossoming in the ordinary course, made innumerable bulblets — hundreds, indeed — and in a few years these hundreds came to perfection and blossomed with the best. This led to an examination of the bulbs as soon as it was noticed that they were not by way of flowering. The inspection disclosed the fact that the bulbs had been gnawed to the heart by mice. So now the way to increase a valuable hyacinth is to take a knife and slash into its very heart with innumerable cross-cuts and plant it in the ordinary way."

I have myself noticed a remarkable increase of snowdrops in a mouse-infected shrubbery, but whether it is due to the kind offices of the mice I have not been able to determine.

In conclusion, some notes as to the colour and size and attitudes of the Red-backed Meadow Mouse may be of interest. "Red-backed" is a good general description, as the upper surface of their coat is a rich chestnut-red in the warm months, and decidedly reddish in winter. It is probable that a high mean annual temperature means a redder, and a low mean annual temperature a greyer coloration; and this appears to be the case with the closely-allied American species, which have been carefully studied. The under surface ranges from cream colour to buff-

MATERIALS USED IN LINING THE NEST OF THE RED-BACKED MEADOW MOUSE.
The grass stems are bitten into short lengths and split in the process.

grey, and sometimes is a fairly pure white. Marked differences in this are also probably due to differences of climate. Immature examples of the species are decidedly less rufous than adults.

The average length all over of a good specimen is about 145 millimetres, while the form peculiar to the island of Skomer, which was first described by Mr. Drane, is some 20 millimetres longer. This increase of size in an island form is remarkable, and has also been noted in some island forms of the Long-tailed Field Mouse.

The pictures give a good idea of several characteristic attitudes of the Red-backed Meadow Mouse. He is capable of standing up on his hind legs, and in this position can make a few ill-balanced hops like the Long-tailed Field Mouse. He can flatten himself and squirm in short grass, or even in loose soil, in such a way that he himself is completely invisible, and his course can only be traced by the movement of what is above him. He burrows with passionate energy, bracing his hind legs against anything that he can reach, and often twisting his body through three-quarters of a circle so that the top of his head points in almost the opposite direction to the top of his tail. In stiff soil he flings fair-sized pellets behind him, but I have not been able to determine whether he cuts these with his teeth and sweeps them back with his fore paws, or employs his fore paws alone.

DOUGLAS ENGLISH.

THE LIFE OF THE SEA-SHORE

By F. MARTIN DUNCAN, F.R.P.S.

Illustrated with Photographs by the Author

THE SEAWEEDS

THERE are few situations more delightful, or so replete with intense interest, as the sea-shore, yet a very small proportion of those who spend their holiday by the sea realise to the fullest extent its many beauties and wonders.

I wonder how many casual visitors, rambling along the sea-shore on a summer afternoon, realise that they are making an excursion through the confines of two kingdoms whose monarchs are for ever striving against each other and encroaching on each other's marches! Yet such is the case, for when we walk along the sea-shore we are travelling along the ever changing frontier line which separates the kingdom of Demeter, Queen of the Earth, from that of Neptune, Lord of the Sea. As we traverse the edge of Demeter's kingdom, keeping a sharp lookout, we soon notice that although many of the inland plants are growing down close to, and even on, the shore, many of our old favourites of the meadow and woodland are absent and their places taken by new kinds—by grasses, reeds and rushes. Of these plants peculiar to the region of the shore and cliffs, is the Yellow-Horned Poppy, with its large golden-yellow flowers and wonderful horn-shaped seed-pods, that measure six to twelve inches in length. The fleshy-leaved, white-flowered Samphire loves the rocks by the sea, and Shakespeare, in "King Lear," has left us a graphic description of the dangers of the Samphire collector, who gathered the plant in those days for medicinal purposes:—

"Half way down
Hangs one that gathers samphire: dreadful trade!
Methinks, he seems no bigger than his head."

There also on the cliffs we may find growing the Wild Cabbage, parent of all domestic cabbages. On the sandy shores grow the Purple Sea-Rocket, the Sea-Kale, Sea-Holly with its beautiful, smooth,

bluish foliage, Sea-Stock, and Scurvy Grasses. These last, together with certain of the reeds and rushes, play an important part in gradually fixing the shifting sands. Other plants peculiar to this borderland of Demeter's kingdom are the Sea-Beet, four kinds of Sea-Lavender, the Sea-Spurrey, Sandwort, and the Tamarisk, which grows so close to the waves on many parts of the Essex and Sussex coasts. Many of these plants show striking modifications, adaptative to their peculiar environment, and are, therefore, worthy of a little close observation.

"THE BORDERLAND OF NEPTUNE'S KINGDOM."

Down on the borderland of Neptune's kingdom, how different are the forms of plant life! Here we find innumerable seaweeds, which clothe the rocks and shore, varying in colour through all sorts of beautiful shades of green, brown, red, and purple. And not only beautiful of hue, but exquisite of shape, are these plants of Neptune's garden.

The most familiar of all the seaweeds are the great masses of Wrack or Fucus, which clothe the rocks from high to low water mark. Although so common, the Wracks are really very interesting, and are always worth turning over carefully, for many marine treasures lurk amongst those tangled masses, such as small and delicate seaweeds, minute shell-fish, etc. This common weed has many popular names, such as Bladder-Weed, Kelp, Black Tang, and "Our Lady's Wrack." All round the English and Scotch coasts it is collected and used by the farmers for manure for their fields. The Irish peasants use it for their potato fields, and in Jersey and Guernsey, so valuable is it for agricultural purposes, there are special seasons regulated by law for the cutting and collecting of the "Vraic," as it is called. Altogether, there are four different kinds of Wrack to be found on the shore—the Knobbed Wrack, sometimes called "Sow-whistle," the Bladder Wrack, the

Serrated Wrack, and the Channelled Wrack. The Bladder Wrack has fronds from one to three feet long, according to the situation in which it is growing, the bladders are in pairs, and the fruit pods (receptacles) also grow in pairs at the ends of the fronds, and are often heart-shaped. The Knobbed Wrack has not quite such broad fronds but much larger bladders; indeed, the fisher lads sometimes dry them and fashion them into whistles. The Serrated Wrack has no bladders, but the edges of the fronds are toothed or serrated. The fronds of this Wrack are frequently partly covered with a delicate whitish tracery, each tiny mesh representing what was once the home of a very beautiful and interesting little creature called a "Moss-animal," or Bryozoon. The Channelled Wrack grows chiefly near high-water mark, seldom below half tide, for it seems to require exposure to the air for many hours every day. Growing in thick tufts from three to six inches in length, destitute of air bladders, and with a furrow in its stem, it is easily recognised.

SEAWEED PARTIALLY COVERED WITH A GROWTH OF BRYOZOA.
(A colony of Moss-animals.)

Although the seaweeds are so numerous and such familiar objects of the sea-shore, yet very few of them have popular names. It is, therefore, practically impossible to write about them without giving them their scientific names, for the scientist has been more eager to examine minutely, and name, each individual weed than has his lay brother. As we stand on the edge of a breakwater, and look down into the water, we shall see that some of the wooden piles have a wonderful growth of beautiful green tubular-shaped weeds upon them. This is known as the *Enteromorpha intestinalis*, which really means "in the form of an intestine," and the weed varies in length and breadth from short, narrow fronds, to tubular ribbons quite two feet long. But it is in the rock pools that we see the seaweeds in all their glory, and according to the situation of each pool on the shore, so we shall find it to contain certain species of seaweeds. In the pools nearest high-water mark, we shall find the Wracks predominating, with the *Enteromorpha*, and a delicate, soft, green growth called *Conferva*, and a deep green weed which the fishermen call "Oyster-green."

In the pools at about half-tide mark, we shall find many beautiful and delicate weeds, with dainty, thread-like, many-branched filaments. One of these, to be found in all tidal pools, is the Red Ceramium, which in its finest condition is a delicate rosy red, its filaments forked at the ends with the joints more or less transparent. The beautiful violet *Polysiphonia* is another denizen of the half-tide pools, growing from about six to

THE LAURENTIA.

ten inches in length, with a main stem or trunk and a multitude of smaller branches, like a miniature tree. On the shady side of the pool, growing from three to six inches in length, with slightly-forked branches of a fine deep crimson colour, is the *Griffithsia*, named after Mrs. Griffiths, who has discovered and described so many of our native seaweeds. If we take a specimen home, and throw it into fresh water, the membrane will burst with a crackling noise, and the beautiful colour be discharged.

The *Laurentia*, named after the French naturalist, M. de la Lauriencia, is a rather interesting weed with a wide shore distribution from extreme high-water mark to beyond low-water mark. It has a flattish frond, and undivided main stem, from which grow out stout branches alternately clothed with lesser branches. This weed has rather a hot, biting taste, and was formerly eaten in Scotland, where it was known as "pepper dulse."

Masses of stony-looking, white-jointed twigs are often very abundant in pools at the base of the limestone cliffs. This growth is the so-called Coralline, which has nothing to do with the corals, as its name seems to imply, but is really a curious seaweed with an outer coating of carbonate of lime. The plant secretes this stony covering as it grows, the vegetable tissues forming a slender stem within. If a dried tuft be held in a flame, it will be seen to burn with a fine white light. By placing a specimen in weak acid, the lime will be dissolved, so that the structure of the plant can be seen.

One of the treasures of the half-tide pools is the Peacock's-tail Seaweed. It is a most remarkable-looking, fan-shaped weed, with graceful fronds expanding in almost perfect half-

THE ENTEROMORPHA.

circles. The fronds are striped across, the colours varying through shades of orange and olive green, with a little red.

THE CARRAGEEN, OR IRISH MOSS WEED.

It is a weed well worth seeking, and is the northern representative of an abundant tropical seaweed.

Another remarkable weed is known as Carrageen, or Irish Moss. In shape it somewhat resembles a crumpled fern frond, varying in colour from a yellowish green to a livid purple or olive brown. At one time a fashionable remedy for consumption, it was collected by the peasantry of the west coast of Ireland, and whilst in repute sold for as much as half-a-crown a pound. The Winged Delesseria is a beautiful, and in some places abundant, weed, which spreads out a mass of exquisite rich red fronds, and is one of the delights of the collector. Another of the most beautiful and at the same time abundant of our seaweeds, is the *Plocamium*, the Braided-hair weed. It grows in perfection in the deep low-tide pools, in delicately fine, much-branched masses of a lovely pinkish red colour, and is also frequently cast up in great quantities after a storm. The great, dark, olive-coloured, ribbon-shaped, wavy-edged weeds, with tough stalks and curious-looking roots, so often cast up by the waves after a violent storm, are called the Tangles, and form wonderful forests of weed beyond low-tide mark, forming a home for all sorts of fish and curious marine creatures. One of these Tangles, the *Laminaria digitata* of the botanist, is collected as kelp for the manufacture of iodine.

What more pleasing memento of a happy holiday spent by the sea than a collection of these beautifully coloured, graceful-shaped seaweeds! And such a collection may be very easily formed. All that is wanted are some sheets of drawing paper cut into convenient sizes, a couple of quires of white, absorbent, botanical paper, a few needles mounted in wooden paint-brush handles, a pair of fine pointed scissors, and one or two camel-hair pencils. A cheap and efficient press may be made out of two pieces of half-inch deal board about two feet long and one foot wide, and a double rug-strap. Having brought home some seaweeds, get a couple of soup-plates and some clean cold water. In one soup-plate cleanse each piece of weed, and then float it out in the second plate on to a piece of the drawing paper supported by your left hand, whilst with your right hand you work with the needles and

brushes to arrange the fronds, thinning out the superabundant branches with the scissors. When the seaweed is arranged to your satisfaction, cautiously raise the paper out of the water, taking care that the position of the seaweed is not altered, and drain off the water. In drying, it is advisable to place a piece of old linen or muslin on top of the mounted weed, to prevent its sticking to the upper paper, and both muslin and blotting paper must be changed at least twice during the drying process. To anyone possessing a student's microscope, the seaweeds and their fruiting organs offer a rich field of beautiful and intensely interesting objects. The space at my disposal, however, will not admit of my describing in detail this interesting subject; I must therefore refer those of my readers who think they would like to take it up, to the chapters on Seaweeds in my book on "Denizens of the Deep."

In looking for the seaweeds, we are sure to see and collect numerous feathery, slender objects, mostly of a brownish hue, and rather horny to the touch. At first sight they might very easily be mistaken for seaweeds, and indeed for a long while they were classed amongst the plants by the early naturalists, their true nature not being thoroughly understood until the microscope became a more perfect instrument, and people began to study the living organism instead of the dead specimens cast up by the tide. Then, however, their real character was soon realised, and they were placed in the Animal kingdom. These graceful, horny-textured objects are really deserted villages, once the home of an active and wonderful animal colony. Careful research in the rock pools will often reveal one of these colonies in the full vigour of healthy active life. Then it will be seen that all along the sides of the stems, tiny, delicately tinted heads, each with a little circlet of feelers, are protruded, making the whole resemble an exquisite miniature garland. It is from their resemblance to a minute spray of flowers that these creatures have gained their popular name of Garland Polypes; their scientific name is the *Compound Hydrozoa*. Some of them live on the rocks in the tidal pools, and below low-water mark, forming a dense growth of fair size; others grow as minute single sprays upon the seaweeds, and on the wooden piles of the breakwaters, or upon the whelk

THE DELESSERIA.

shells which the hermit crabs use as their homes. They are really very wonderful and interesting little creatures, these Garland Polypes, and the life-history of a large number of them is very remarkable. There is a minute form to be found growing as a single polype upon the rocks in the tidal pools, which is called the *Hydra tuba*, and looks during the winter months something like a tiny urn with a circlet of feelers or tentacles. As the season advances the little tubular body may be seen to lengthen, and to have a series of waist-like constrictions. Soon the portions of the body between the waists become marked with eight lobes, and look rather like a tiny pile of saucers placed one on top of another. Next some feelers grow out round the edge of the bottom saucer, and then all the upper saucers break off, separate, turn upside down, and swim away, tiny, umbrella-like things, as baby Jelly-fishes. All through the summer months may be seen the fragile Jelly-fishes moving leisurely in the sea, but with the approach of autumn they produce young, which settle down upon the rocks and grow into *Hydra tuba*.

THE PLOCAMIUM OR BRAIDED-HAIR WEED.

While the little Jelly-fishes are produced simply by the division of the body of the *Hydra tuba*, a purely non-sexual process of reproduction, the sexes are distinct in the Jelly-fishes themselves, so that their offspring, the *Hydra tuba*, is the result of sexual union. This wonderful life-history of a sexless individual giving rise to male and female creatures, which in turn reproduce the sexless form, is called an alternation of generations, and is one of the most remarkable phenomena of Nature.

We have already noticed the delicate tracery of the cells of one of the colonies of Moss-animals (*Bryozoa*), partially covering some of our specimens of the Wrack weeds, and on looking over our gatherings we are pretty sure to find that we have picked up one or two specimens consisting of handsome frond-like masses, that appear as if their whole surface had been most carefully and evenly pricked with a pin. These are specimens of the *Flustra*, or Sea-mat Bryozoa, and each of those pin-holes represents a tiny dwelling, wherein once lived a little Moss-animal, and when all the members of the colony were alive, and each thrust out its tiny feeler-clad head, then the *Flustra* indeed looked as if covered with a growth of moss. There are many species of these Moss-animals to be found along the shore and in the tidal pools, some of which closely resemble the Garland Polype colonies in appearance, and are well worth collecting for their graceful forms alone.

F. MARTIN DUNCAN.

HOW TO KNOW THE BIRDS

By the REV. MAURICE C. H. BIRD, M.A., M.B.O.U.

With Photographs by
RICHARD AND CHERRY KEARTON

THE FINCHES

THE Finch family—more numerous in species than any other—are remarkable for the short and powerful structure of their beaks, which, when closed, form a stout cone, well adapted for cracking hard-shelled seeds. The resident pale brown Corn Bunting and the winter visiting brown and white flecked Snow Bunting, both members of the Finch family, have an additional special beak development, in the shape of a hard bony knob on the palate. The latter bird retains the Lark and Pipit-like straight hind claw, which may act as a tiny snow-shoe, and the white patches in its plumage—though strikingly conspicuous at times—may serve a protective purpose when the ground is snow-clad.

The Snow Bunting is a regular winter visitor to our coastline—sometimes in large flocks, but its numbers and frequency greatly depend upon the severity of the weather. Continued hard weather will drive them inland to seek food upon the stubbles—a happy hunting ground where Finches and Buntings do incalculable good by devouring noxious weed-seeds. The whitest example of the Snow Bunting that I have seen was shot whilst feeding, with a mixed assembly of other small birds, upon the refuse left from a threshed-out wheat-stack. During hard weather a stack-yard becomes a splendid "study" for the ornithologist, for as great a variety of bird-life follows the threshing machine as follows the plough at any season of the year, and a newly-mown field, marsh, or lawn has a similar attraction in summer for both grain and insect feeders. Many birds, too, accompany grazing cattle—Wagtails and Starlings especially—to feast upon the

CORN BUNTING'S NEST.

YELLOW HAMMER'S NEST.

MALE CHAFFINCH AT NEST CONTAINING YOUNG.

YOUNG CHAFFINCHES.

worms pressed out of the ground by the footsteps of the cattle, and the insects attracted by their bodies and their droppings. I add such remarks as these because they bear upon our subject "How to know the Birds," by enabling us to anticipate what species we may expect to come across at certain times and under certain circumstances.

Our local Norfolk name of "Thick-headed Lark" for the Common or Corn Bunting, the largest and most soberly clad of its species, may give an inkling as to the derivation of the word "Bunting." For this family are not only Lark-like in size—the Corn Bunting is so in plumage also—but with their less sharply pointed beaks and less delicately elongated bodies, they carry their heads more closely tucked into their shoulders, which gives them a comparatively "bunted," or stunted appearance. Though the alternate name of Corn Bunting would suggest a resident of arable land pure and simple, this bird not infrequently breeds on the confines of marsh-land. Like the Lark, it is very fond of a dust bath, and may, therefore, often be noticed on roadside fences; and where telegraph wires are present it, together with Yellow Hammer and Stonechat, frequently avails itself of them as a perch from whence to pour forth its reiterated and unmelodious song, which Mr. Dixon has aptly rendered by the words "See-see-see-I-I—I'm-he-r-r-re." Like the other Buntings, it is somewhat sedentary in summer, and seldom strays far from its nest, which is built on the ground. Typical of the species also are the eggs of the Corn Bunting, which are streaked with clearly defined black markings upon a more or less pale lilac ground—for this reason the name of "Writing Lark" or "Scribbling Finch" has been given to both the Corn and Yellow Buntings. The short and apparently laboured flight of the Corn Bunting is distinctive in that the legs are carried dangling down below the body, and not stretched out straight behind, or gathered up into the breast feathers, as is the general rule.

The well-known and far more widely distributed Yellow Hammer better deserves the title of Common Bunting; its abstemious and economical song about "a little bit o' bread and no cheese"—with much stress upon the latter item—is familiar throughout the country, and its presence may as surely be expected where the golden gorse grows, as the Yellow Wagtail may certainly be looked for where the same-hued Marsh Marigold, and later on the Yellow Iris, abound. However monotonous the Yellow Hammer's song may be, it is especially welcome when we hear it in early spring before the regular migrant songsters have arrived,

and again in early autumn long after they have departed, or, at any rate, ceased to sing. The late song of the "Guler" is accounted for by the fact that it is double-brooded. August is the most silent month of the year so far as the music of the birds is concerned, but the Yellow Hammer still persists, and on Aug. 27th, 1903, I found eggs still unhatched. Three seems to be the common complement, especially of the later clutches.

Not to be confounded with the Yellow Hammer is the Cirl Bunting, a bird which is of far more restricted range, and chiefly to be found in the south of England. The male of this species has the chin, cheeks, and throat black in the breeding plumage; otherwise it is, to all appearances, a rather small and shy Yellow Hammer, and is, perhaps, rather more a bird of the trees than of the fences. In both species the females are less highly coloured than the males, and in winter both sexes are rendered less conspicuous by brown feather tips, which subdue the bright canary yellow of their heads and under parts.

The Reed Bunting is not restricted to reed beds, for wherever there is a piece of water of any extent supporting rank vegetation around it — be it sedge swamp or osier ground— there the resident Reed Sparrow may be looked for. The male is not very strikingly arrayed, but his black cap and throat, relieved by white-splashed cheeks, and his two white-webbed tail feathers, conspicuous in flight as he flits from one spray to another, are pretty sure to attract attention, if his "tscheeing" call-note cannot be heard. Should his ground-placed nest be discovered, and his more Sparrow-like mate be incubating her typical Bunting eggs (but more darkly grounded and less finely scribbled than those of the Yellow Hammer), he will strive to attract attention to himself by his cries, whilst she will indulge, perhaps, in the well-known Partridge-like device of fluttering helplessness.

One of the first signs of real spring is the sprightly song of the gay Cock Chaffinch, the Bachelor Finch of Linnæus, who first observed, or at least first recorded, the autumnal separation of its sexes. The metallic call-note of the male has given it, in many countries, the sobriquet of "Spink," a name which will surely serve to identify one of the

FEMALE CHAFFINCH AT NEST.

most beautiful of our birds at a distance, when its rosy pink breast, black forehead, blue grey crown and nape with yellow green back, and two white wing-bars, cannot be seen. It has been said

A COCK SPARROW.

that the Wagtail is the smallest bird that walks—for most small birds hop—but if carefully watched, the Chaffinch will also be noticed to use the apparently more comfortable mode of progression. With the exception of the Scotch fir, evergreens are seldom selected as a site for what may be considered the most beautiful of British bird-nests; indeed, only those of the Golden Crested Wren, Long-tailed Tit, and perhaps the Lesser Redpole, can compare with it.

In winter dress, with colours more subdued, the Chaffinch might be confounded with the Brambling, a northern migrant which sometimes comes South in numbers during the winter months, consorts with Chaffinches in the fields and woods by day, and roosts with them in the shrubberies at night. The Brambling, however, is a slightly larger bird, and shows no pink or green shade in his feathering, the prevailing hues of which are black and brown and tawny yellow, with a conspicuous white rump when in flight. In the dead season beech mast is as attractive to both these birds as acorns are to Wood Pigeon and Wild Duck.

The smaller and more shy and delicately shaped Tree Sparrow is nowhere nearly so abundant as the cheeky and maligned House Sparrow, but from its similarity to the latter, it is, perhaps, frequently overlooked. It seems to be extending its range, and is most likely to be met with in winter when its ranks here are recruited by migrants from abroad. It is to be distinguished from its more persistent relative by the fact that both sexes are similar in plumage; the head of each is chestnut brown, there are two white wing-bars instead of one, and there is a conspicuous patch of black on the side of the cheek, surrounded by white feathers, the latter almost encircling the neck. Scarcely any nesting site comes amiss to the House Sparrow; it builds both a clumsy, independent nest in the branches of tall trees, or upon those trained on a wall; in holes of trees; or walls, or thatch, under tiles, in gutter-pipes, in House Martins' nests; under those of the Rook, and even amidst a colony of Sand Martins. The Tree Sparrow, however, never utilises an open site, but always selects a hole, either in some hollow tree—a pollarded Willow frequently—in outside brickwork or stone wall, or, as on the house in which I write, in old and closely clipped ivy where the accumulated growth of closely interwoven stems extend some six or eight inches deep from the wall. Ivy-clad buildings of any age are a great attraction to birds—in spring for nesting, and in winter for roosting purposes. In and on the ivy-clad ruins of East Somerton church I have found the eggs of Kestrel and Sparrow Hawk, Barn Owl, Jackdaw, Starling, Thrush, Blackbird, Flycatcher, Robin, Wagtail, Cuckoo, Pigeon, Hedge Sparrow, Wren,

GREENFINCH.

GREENFINCH'S NEST.

HAWFINCH'S NEST.

Greenfinch and Chaffinch, besides House and Tree Sparrow. Pheasants frequently nested at the base of its walls, and, doubtless, had not the local race of Stock Doves been accustomed to make use of the sand-hill rabbit burrows, they, too, would have resorted to the ivy-mantled tower for nesting.

The chief characteristic of the Greenfinch is its greenish yellow body colour, which passes in the male into bright yellow on the margins of its flight feathers and at the base of the tail; both of these points are shown off whilst the bird is either flying or courting. The monotonous song, if such it can be called, is equally distinctive, as is also the oft-uttered call-note — "maree —maree." The Greenfinch is one of the commonest birds of garden shrubberies, and almost as destructive to vegetating garden seeds—especially those of the cabbage tribe—as the Chaffinch.

LINNET'S NEST.

The Hawfinch—another bird that has so extended its range within the past twenty years that it is, though still somewhat local, no longer to be looked upon as one of our rarer birds—is somewhat Bunting-like in shape; its very heavy beak, short neck and tail, give it a very lumpy appearance. It haunts the outskirts of woods (neither birds nor insects seem partial to the central parts of large woods) and shrubberies, and although its beak is well adapted for cracking hard-stoned fruit, it is very partial to garden peas. Though a naturally shy bird, it is very difficult to scare away when once it has begun upon a well-podded row; it takes itself off upon the slightest alarm only to return as soon as danger—in the shape of the gardener—disappears. Jays and House Sparrows also sometimes play havoc with this toothsome esculent. The latter bird's presence amongst the pea-sticks may, however, be occasionally excused, because it preys upon both Weevils and Pea Moth—the prime cause of maggoty peas! No such excuse, however, can be made for the Hawfinch, whose chief recommendation lies in the sober quaintness of his appearance, and the delicate fawn-coloured body plumage, which on the under parts is tinged with a faint suspicion of lilac. He has a black bib, and a black line encircles his lead-coloured beak and eye, the iris of which is greyish white. Another peculiarity is that the fifth to the ninth blue-black flight feathers are re-curved like the point of a bill-hook. The short, black tail fades to grey at the tip. In autumn the Hawfinch is as fond of the seed of the crimson-pulped yew berries as are the Thrush family of the pulp itself.

The Goldfinch, beloved of cage-bird fanciers, has greatly decreased in numbers of later years. It is particularly a bird of the old-fashioned orchards, and delights in lichen-infested apple trees for nesting purposes, and in derelict thistle-covered land as a winter feeding resort. Where the knapweeds abound, too, Goldfinches may also be looked for, as the seed of these plants, especially of *Centaurea*

nigra, or "Hard-head," is much beloved by them; it ripens late, is held long by the plant, and stands up well above the average level of any English snow-fall. The golden-coloured wing patch, from which the Goldfinch derives its specific name, is well displayed whilst it is hanging on to, and extracting the seed from, the swaying tops of either of these weeds, and the bright, blood-red forehead and throat, black nape and white cheeks and under parts, may then be observed. So, too, the white-tipped tail and flight feathers are conspicuous as with cheery call-note this sprightly bird flits from one feeding plant to another.

Siskins are best known as cage birds, not perhaps on account of their rarity, but because, generally speaking, they only visit us in flocks in winter, and then confine themselves to plantations of larch and fir, birch and alder. The seeds of the two last-named trees are most esteemed by them. Siskins are very active and Tit-like in their attitudes whilst extracting seed from the pensile catkins. In captivity they soon become exceedingly tame, and readily hybridise with the Canary, to which, indeed, they are nearly related. The female is not unlike a small Green Canary with a short and deeply notched tail, but the male bird has a black crown and bib.

The Linnet, Twite and Lesser Redpole have this much in common—all three are small brown birds, and small in the order they are mentioned; the sexes are similar except that the females have no red on head, breast or rump. Adult male Linnets (sometimes called Brown or Grey Linnets to distinguish them from the Greenfinch or Green Linnet) have the forehead and breast crimson pink, fading off to white on the under parts. The Twite or Mountain Linnet (so called from its breeding haunts, for it descends to the lowlands in autumn) has no red on forehead or breast, but the rump is rosy, and the beak is yellow instead of horn-coloured as in the two other species. All three are gregarious in winter. The Lesser Redpole has the winter habits of the Siskin, and consorts with it in feeding upon alder and birch seed. The latter tree is frequently chosen to receive the beautifully-woven little nest, which is cosily lined with cotton down from the catkins of poplar, sallow, or willow. In addition to the smaller size of the bird, it is to be distinguished from both of the foregoing by a double white wing-bar and the presence of a black patch on the throat, while the rump is a dull white.

Conspicuous amongst the Finches on account of the strong, compressed beak, jet black crown, flight, and tail feathers—contrasting strongly with snow-white rump—the Bullfinch is well known in all well-wooded districts. The male only has the lovely carmine breast, and the black cap is not developed in either sex until after the first moult. In winter, pairs, and sometimes family parties, pay unwelcome visits to gardens and orchards for the purpose of feeding upon the buds of fruit trees—especially those of stone fruit; but pears, gooseberries, and currants are all attacked. The House Sparrow is perhaps a worse and more usual offender in the case of the two last-named bushes, and Tits sometimes attack the blossom buds of various fruit trees, but only in search of hidden insects, their minute eggs or larvæ. No such extenuating circumstances, however, can be pleaded on behalf of the Bullfinch, which when it dissects the damson buds does so merely for the purpose of devouring the tender vegetation which they contain. So rapid are they in their destructive work, that unless there be several trees together for them to act the part of Nature's pruners upon, the chances are that they will have "been and gone and done it" ere the damage is discovered. They are very shy and secretive in their movements, their rather mournful, piping call-note, or the conspicuous white rump, being the items most likely to attract attention to their presence.

When once an orchard is attacked by Bullfinches they are difficult to scare away, and are loth to depart even when frightened by the human voice, retreating one by one a little way, only to return as soon as danger disappears. Should a family party suddenly be surprised in the act of despoiling the trees, the bird nearest to the disturber will immediately throw himself away from his work, bound through the branches, and at once be

MALE BULLFINCH AND YOUNG.

followed by his guilty comrades in single file; but they will only retire about a stone's throw ere settling down to await the departure of their enemy. Should they be pursued still further, the same tactics will be repeated with dipping flight, until they either double back, or, having gained the boundary fence, will challenge the pursuer to a game of hide and seek upon the further side. So invariably do they resort to such methods of retreat that it is quite a distinctive mark of the species, but if their whispered pipe-call be not heard meanwhile, the conspicuous white back is sure to attract attention as Bully flees away. For nesting purposes a thick thorn fence is usually selected, especially one draped with depending brambles; the nest itself being somewhat like that of the Greenfinch, but with a stronger surrounding and more decided platform of small dead sticks and roots supporting it. The eggs, too, are of the Greenfinch type, but not quite so elongated, and the darker markings, upon a bluer ground, are more nearly confined to a zone at the larger end.

It seems a pity to pass over the adroit Crossbill, which, however, is doubtfully cosmopolitan enough to deserve mention in a list of the commoner British birds. Its singularly distorted beak is a very beautiful example of adapted structure, and the birds themselves are so tame that if one does happen to come across a little flock feasting in winter upon larch or Scotch fir cones, their unique method of utilising the half-opened beak as a double lever for prising open the cone valves, in order to secure the resinous seeds, may easily be watched by a patient observer. Of strong build, and with short neck and tail, and powerful feet, they are in shape somewhat like a small Hawfinch, though their antics and plumage — dull green, variegated according to age and sex, with orange and red—are more Parrot-like.

MAURICE C. H. BIRD.

BULLFINCH ON NEST.

FOXGLOVES.

From the Water-Colour Drawing by Mrs. Allingham, R.W.S.

HOW TO KNOW THE TREES GROWING IN BRITAIN

With Notes, descriptive and photographic, for their Identification in all Seasons of the Year

By HENRY IRVING

THE BIRCH AND THE HORNBEAM

THE slender grace of the Silver Birch impresses everyone. Few of our trees are so well loved. Coleridge's descriptive title "Lady of the Woods" meets with instant approval. Yet, perhaps, the limiting word of that description scarcely holds. If the "Lady" Birch loves the woods she loves the open daylight better. Left to her own devices she will be found more often fringing the forest, where are free air and sunshine, than languishing within its confined shadows. For, indeed, the Birch loves most the open spaces, breezy uplands amongst the bracken and heather, even the higher mountain slopes whither the Scots Pine will scarcely venture. That slender grace of the "Lady" Birch is associated with a splendid hardihood, and power of adaptation, unattained by sterner-seeming trees. Loving thus the open air and the unshaded light, the Birch is, by these, nurtured to the utmost refinement of enduring tenderness.

TRUNK AND BARK OF COMMON BIRCH

We have in Britain two chief varieties of Birch, which amongst other distinctions may be most readily recognised by the habit of their terminal twigs. The one, the Common Birch, has these spreading, or erect; the other, the White Birch, has them drooping, and sometimes in long festoons.

In *winter* the slender grace of the Birch is perhaps most apparent. Its darker twigs gleam in the sunshine, giving emphasis to the clear white of the central stem. Seen, as these trees often may be, marking the margin of a Pinewood, they spread there a subdued light which, like atmospheric haze, softens the dark masses of the trees behind. But it is when seen against the sky, with a depth of unbroken blue or rounded mass of sun-lighted cumulus cloud for background, that the

individual grace of this tree most appears. Then the rich tracery of its curved branchings is fully revealed in glistening bronze—outflowing, tapering to utmost fineness, intermingled but never involved, tingling with life to the farthest fibre, scarcely less evident in this its winter's "beauty" sleep than in the coming spring's awakening.

WINTER TWIG AND LEAF-SCAR (ENLARGED) OF THE BIRCH

In *spring* the newly unfolded leaves spread themselves out, or droop half-pendulous, according to the inclination of the twigs, overspreading like a green mist. Crowds of catkins, brown changing to yellow, hang and quiver in front of the dainty leaves.

In *summer* the catkins have disappeared, the leaves have darkened in colour on the upper surface and have become more tremulous, moving with the slightest breath of wind so lightly poised are they, scattering scintillations of light.

George Meredith in "The Egoist" gives the following word-picture of the tree which is inimitable in its beauty and descriptive fulness: "See the Silver Birch in a breeze; here it swells, there it scatters, and it is puffed to a round, and it streams like a pennon, and now gives the glimpse and shine of the white stem's line within, now hurries over it, denying that it was visible, with a chatter along the sweeping folds, while still the white peeps through."

In *autumn* the tree again shows crowds of catkins, more hidden away among the leaves than were those of spring. These are fruit-catkins ranged along the twigs, pendulous, ripening to dryness among the yellowing leaves which they outlast, remaining more or less the winter through.

The distinctive *bark* of the Birch is thin and silver white, with thin dark lines running transversely, and occasional rough dark patches. Flakes of this bark are shed from time to time, peeling off like paper in the direction of the transverse lines, so new bark, like finest woven silk, is constantly exposed, and the silvery whiteness is maintained from year to year. But in some trees the silvery whiteness gives place to a golden brown; whilst in those with the pendulous branch-tips the bark at the base for several feet becomes rough, very corky, with deep fissures.

The *winter twigs* are bronze-coloured, smooth on the pendulous variety, slightly hairy on that with spreading branch-tips.

The *resting buds* are arranged spirally on the twigs. They are somewhat spindle-shaped, shorter, and in proportion stouter, than those of the Beech, enclosed in reddish brown scales, and pressed towards the twig. The leaf-scars are small, half-oval in shape, and show three tiny leaf-traces. The *leaves* vary, but in the main are triangular, often with an extended sharp point at the apex. The margin shows wide serrations with smaller ones intervening. Their colour is deep green, rather shiny above, paler below, slightly translucent. The change in *autumn* is to yellow,

BIRCH LEAVES.

LIGHT-LOVING BIRCHES FRINGING A PINE-WOOD.

COMMON BIRCH IN WINTER.

orange and brown. The midrib runs direct to the apex, the side ribs branch right and left, and terminate in the larger

GALLS ON BIRCH TWIGS.

serrations at the margin. The stalks of the leaves are comparatively long, about half as long as the midrib, and give a delicate poise. The leaves scarcely hide the tree's framework, and cast but a slight shadow.

The *flowers*, pollen-bearing and fruit-producing, are separate, but to be found on the same tree. They are both crowded into cylindrical catkins. The pollen-bearing catkins make their appearance in August, and remain in position all the winter through, stiffly erect in relation to the twigs which they terminate. In the spring they elongate, and fall over, hanging loosely pendulous, ready for the wind to shake out and scatter their pollen dust. All through the winter the fruit-producing catkins are safely packed away in the lateral buds of the twigs, and emerge erect with the leaves in the spring.

The *fruit* has the appearance still of a catkin, for the erect flower-catkin, lengthening slightly, has turned itself, pointing downwards. It now suggests a stiffish rounded tassel of threaded discs, though these discs are really elongated scales with wings so arranged that their combined edges become circular. When fully ripe, well on in the winter, these scales drop off, setting free the tiny seeds, and leaving exposed the central stalk, or thread, of the catkin, which remains long on the twig. The seeds have two round transparent wings, or sails, presenting considerable surface to the wind by which their dispersal is secured.

A rather frequent *gall* found on this tree is that caused by the Birch gall mite, a similar insect to that which affects so disastrously the Black Currant buds in our gardens. The buds infested by this mite either do not open or expand irregularly.

Another abnormal growth, and one that is peculiarly disfiguring to this tree, is that known commonly as "The Witch's Broom," a crowd of short twigs inextricably involved and massed, which grow eventually to a great size. By some this is said to be the result of the tree's efforts against the crippling action of the gall mites referred to above; but it is also explained as due to similar efforts against the mischievous ramifications of a minute fungus.

THE HORNBEAM.

The Hornbeam stands in sharp contrast with the Birch. In its younger stages, at least, it well endures if it does not show a preference for shade. It casts

TRUNK AND BARK OF THE HORNBEAM.

heavy shadows. Against the delicate grace of the Birch it appears almost ungainly. Breaking into branches generally rather low down, these rise stiff and spreading in a way that would seem to justify the description "cabbage headed." Yet the Hornbeam has a character of its own which is distinctly interesting; and, at certain seasons, a beauty which on its own lines is unsurpassed. Unfortunately the tree has endured much hard treatment in the past, for its wood proves very serviceable for the cottagers' fires. Where Hornbeams abound, as in Epping Forest, every tree has been roughly pollarded and all character lost. When allowed to live its own free life it has much in common with the Beech, which, in fact, it so resembles in many features that it has doubtless often been mistaken for that tree by the casually observant; hence its reputation for being more rare than it is.

THE HORNBEAM IN EARLY SPRING.

In *winter* its long ascending branches should be noted. In some situations and seasons its dried brown leaves still remain attached, as do those of the Beech; and, longer still than these, the ripe fruit clusters.

In *spring*, when its full grown multiplied catkins of pollen-bearing flowers clothe the whole tree, whilst the young leaves are yet small and inconspicuous, the Hornbeam presents, perhaps, its loveliest appearance, adorned as it were with tassels of silver and tinsel of fine gold, shimmering in the sunshine.

In *summer*, with leaves fully expanded and so spread, as with the Beech, to intercept every possible light-ray, it shows dense masses of foliage of a rich deep green, but less reflective of light than that of the Beech.

In *autumn* the first effect of the growing fruit clusters is to make the foliage appear still more dense as fruit and foliage blend together. Later, the foliage thins somewhat, but the lengthened fruit-tassels, expanding their full-grown wings, fill

up vacant spaces. Later still, when foliage and fruit change to yellow and then to russet brown, the tree has yet another beauty; and this it may hold, more or less, well on into full winter days.

The *trunk* is cylindrical, like that of the Beech, but, in distinction from that tree, is fluted as though a number of lesser stems had coalesced. But this fluting is not always very apparent until the tree has attained a good age. The *bark*, also like that of the Beech, is thin and smooth, and grey in colour. But here, again, is considerable variation, probably resulting from difference of soil and situation; it also roughens with age. The winter *twigs* are not so smooth as those of the Beech, slightly hairy, and less zigzag. The *resting buds* are placed alternately on the twig; they are somewhat flattened, and pressed up against the twig. They show numerous scales. Leaf-scars are crescent-shaped, with three small "traces" of the severed tubes. The *leaves* are oval and pointed like those of the Beech, but their dark green is without gloss, and their margins are doubly serrated throughout. They are slightly "gimped," and this gives them an apparently wavy outline. The midrib runs direct to the apex, and the side ribs (twelve to fourteen pairs of them) in parallel straight lines terminate in the larger serrations at the margin.

WINTER TWIG AND BUD (ENLARGED) OF THE HORNBEAM.

The pollen-bearing and fruit-producing *flowers* are distinct, but grow on the same tree. They are grouped into pendulous catkins and appear with the leaves. The catkins of pollen-bearing flowers grow out from lateral buds on the last season's twigs, and terminate short new shoots. The catkins of fruit-producing flowers grow out from lateral buds nearer the tip of the twig, and from the terminal bud itself. They are more loosely constructed, pale green in colour, with leaf-like pointed scales which curve backwards. The pollen is conveyed by the wind. The clustered *fruit* hangs in long tassels, something like those of the Sycamore; but here a curious leaf-like appendage, forming a kind of triple wing, to which two corn-like fruits are attached, takes the place of the double wing of the Sycamore, and answers a like purpose, aiding dispersal by the wind.

LEAVES OF THE HORNBEAM.

The following table gives the permanent and easily recognisable *distinctions between the Beech and the Hornbeam*, ignoring those which are peculiarly subject to variations in the habits of both trees.

	Beech.	Hornbeam.
To distinguish by buds.	Long, spindle-shaped; project boldly from twig.	Short, thickened, angular; pressed up to twig.
To distinguish by leaves.	When young, fringed with silky hairs; without visible serrations; polished surface; 8-10 pairs of side ribs.	No silky fringes; doubly serrated; matt surface; 12-14 pairs of side ribs.
To distinguish by flowers.	In rounded clusters.	In pendulous catkins.
To distinguish by fruit.	Two triangular nuts in a bristly capsule.	Long drooping clusters, with distended triple wings, to which two corn-like fruits are attached.

HENRY IRVING.

THE ROMANCE OF A RIVER—II

By J. LOMAS, F.G.S., A.R.C.S.

Photograph by Taunt, Oxford.

"THE THAMES ITSELF . . . . BEGINS AS A MERE TRICKLE."

SO far we have studied a small stream from its birth in the hills until it loses its identity on joining a large river. We now have to compare the large example with the small one and see in what respects they agree and how they differ. Obviously the torrent stage will be the same in both, for the mighty river is only the result of the fusion of many small contributory streams. The Thames itself, the noblest of English rivers, begins as a mere trickle rising from the Seven Springs in the Cotswolds. The following inscription has been carved on a stone near the mossy pools from which the feeders take their origin :—

HIC TUUS
O TAMESINE PATER
SEPTEMGEMINUS FONS.

In the river proper the differences we find are more of magnitude than of kind. Like the brook, it swings in rhythmic curves, but these, being dependent on the volume of water, are naturally much larger. In place of the tiny loops a few yards in diameter they are sometimes measured in miles.

In the case of the Mississippi they are from three to six miles across, and in some instances the curves are so sharply folded that in travelling down the river you may

be only half a mile away from a certain point across the neck, and yet be twenty or thirty miles distant if you go by water.

If a county map of England be examined, it will be found that rivers have been very largely used to define the limits of counties and parishes. No doubt they were chosen in times long past as providing an easy, natural, and clear line of demarcation. Perhaps, too, the idea of permanence was a factor in the minds of those who determined that rivers should serve as boundaries. If so, they were sadly mistaken. The River Mersey, for instance, runs as a thin line between Lancashire on the north and Cheshire on the south; but reference to an ordnance map will show that portions of Lancashire are on the south side of the river and parts of Cheshire are on the north. Similarly, Cheshire and Flintshire exchange plots on each side of the Dee, Derbyshire and Leicestershire along the course of the Trent, and Shropshire and Merionethshire on alternate banks of the Vyrnwy. In the sketch map on the opposite page a portion of the River Dove is given which serves to limit the counties of Stafford-

"THE MIGHTY RIVER IS ONLY THE RESULT OF THE FUSION OF MANY SMALL CONTRIBUTORY STREAMS."
The source of the Lowther.

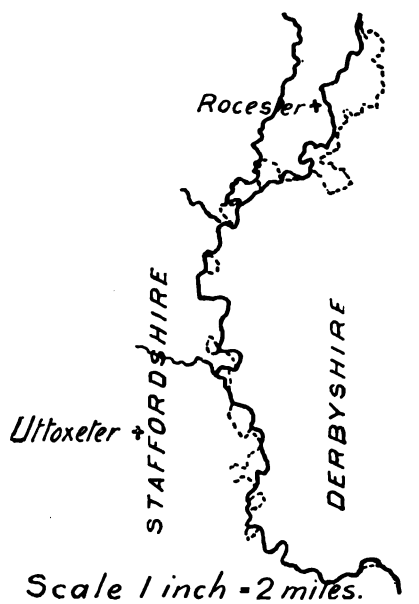
"THE RHYTHMIC CURVES ARE NATURALLY MUCH LARGER."
The Dee at Chester.

shire and Derbyshire. The river is represented by a continuous line, while the broken lines, sometimes coincident with the river and at other times forming loops on either side, show the county boundaries.

These curious anomalies simply resolve themselves into a consideration of the changes which the rivers have undergone since the boundaries were established. An interesting case occurs near London. North Woolwich is in the County of Surrey, and yet it is on the Essex side of the Thames. These examples, and many others which might be quoted from other parts of the country, tend to confirm what we discovered when dealing with our type stream. Rivers are not mere dead features on the face of the country, but active, changing—living.

THE CURVES OF THE WYE.

A river in its upper reaches has usually sufficient carrying power to sweep its course clear of the *débris* loosened by itself or by frost from its banks. Hence the bed is on rock and clean from sand. But in the plains, with diminished velocity, it is incapable of carrying anything but the finest mud in suspension, and the coarser particles accumulate on its bed. Then comes flood time, when a great scouring takes place. The sand is swept further down stream, or spread over the surrounding country to form the "flood plain." Finally the sea is reached, the current is arrested, and it drops all its burden. Should it enter the sea by a wide estuary, the inrush of tidal waters twice a day sweeps the *débris* brought down by the river up and down stream with the flood and ebb. As a rule, the velocity of the ebbing tide is less than the flowing tide, and more suspended material is carried inwards than outwards. This results in a gradual accumulation of sand, and finally the estuary may be silted up. At low water sandbanks are left high and dry, and through these the current flows in uncertain and tortuous channels. But if the estuary narrows near its mouth, the rush of water through the small opening keeps an open waterway.



THE RIVER DOVE AS COUNTY BOUNDARY.
Showing how the river has changed its course.

21

The estuaries of the Mersey and the Dee afford very striking contrasts. They open into the same sea, they are subject to very similar tidal conditions; but while the Dee is V-shaped with the wide part of

"ITS BED IS ON ROCK AND CLEAN FROM SAND."
The Strid: Wharfedale.

the V facing the sea, the Mersey is bottle-shaped, three to four miles wide inland, and the neck of the bottle, less than a mile wide, is turned seawards. So it happens that Chester, once a flourishing port, has lost its former importance in this respect. Only vessels of small tonnage can approach its wharves, and these only at high water, whereas Liverpool has become the great gateway to the West, and the largest vessels afloat can enter its docks.

Now let us consider what would happen if the river on entering the sea were not subject to tidal influences, or if the tides were feeble as compared with the current of the river. Such conditions are found in the Mediterranean. The waste brought down by the Rhone, the Po, and the Nile does not get redistributed by tidal action, but falls to the bottom of the sea when it meets the salt water. Thus vast quantities of sand and mud are constantly tipped over the banks which form at the mouths of these rivers. These banks grow outwards like a fan, and in the end form low, swampy deltas, traversed by "distributaries," which radiate from the point at which the delta first began to accumulate. The amount of material brought down by rivers varies with the seasons. When the Nile is in flood, the water which passes through Cairo is like chocolate in colour. The Yellow River

"IN THE PLAINS IT IS INCAPABLE OF CARRYING ANYTHING BUT THE FINEST MUD IN SUSPENSION."
View on the River Sulby above Greenland Bridge.

"AT LOW WATER SANDBANKS ARE LEFT HIGH AND DRY."
The Mawddach from Panorama Walk, Barmouth.

Thus even at a distance in looking over a valley we can tell at once the nature of the ground.

It is obvious, too, that the more rapid a stream is the greater power it will exercise in deepening its channel. If two streams have their origin at the same altitude, and one takes a short, direct route to the sea, and the other follows a longer and less direct course, the shorter, owing to its more rapid fall, will cut back its channel more quickly than the longer one. Thus we come to see that some streams are possessed of certain advantages even at their birth which enable them to

and the Amazon bring down so much fine mud in suspension that the sea is coloured for many miles from the coasts. The Rhone is fed by melting glaciers, and owing to the presence of suspended rock flour, is milky white until it clears itself on traversing the Lake of Geneva. We cannot conceive the vast quantities of waste which the great rivers of the world are constantly depositing in the oceans. What we must keep in mind is the fact that all this comes from the land. It may be stated as a simple rule that while the land gives much to the sea, the sea gives nothing to the land.

Rivers play an important but not the principal *rôle* in excavating the solid rocks, but they are pre-eminent as agents of transport. The excavating power of a river depends on two factors — the hardness of the rocks and the quickness of fall. We have already seen that when traversing hard rocks the stream is confined to a narrow channel and cuts a gorge with almost vertical sides, and when it flows through softer material it tends to widen its valley

"THE STREAM IS CONFINED TO A NARROW CHANNEL AND CUTS A GORGE."
A view on the Lowther.

outstrip their less fortunate neighbours in the struggle for existence. The more ground they obtain as their own, the larger amount of rain they will obtain to swell their streams. They may not be so serviceable as their poorer brethren; their rapid and precipitous courses will not float argosies, nor do they tend to bind communities together by serving as a means of communication. They spend their energies in mad rushes; they give nothing to the thirsty lands through which they run, and finally on plunging into the great abyss of ocean they are swallowed up and forgotten.

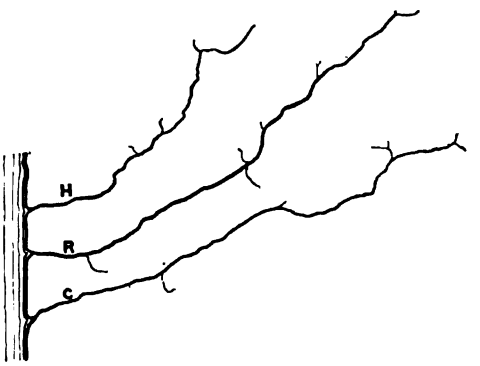
"THE TORRENT IS A SPENDTHRIFT."

Of late years attempts have been made to control some of the redundant energies of streams such as these. Power stations have been erected at the foot of Snowdon and elsewhere. The water is led through turbines, which produce electrical energy, and this is carried over hill and dale to centres of industry, and put to the service of man. But the torrent is a spendthrift. When the clouds have filled it to overflowing, it sheds its treasures without stint, with no thought of the drought which finds it with no reserve and almost helpless. To ensure stability the stream must be taken in hand at an early stage, its waters stored in a reservoir, and

"THE DROUGHT FINDS IT WITH NO RESERVE."

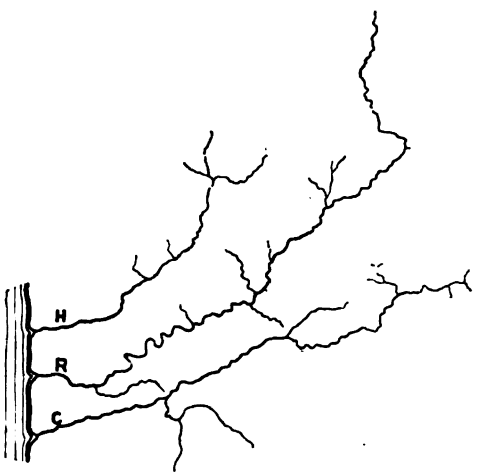
thus made of service all through the seasons.

Let us imagine three rivers, H, R, and C, beginning their careers on a slope of land which has just emerged from the sea. As yet the ground has not been



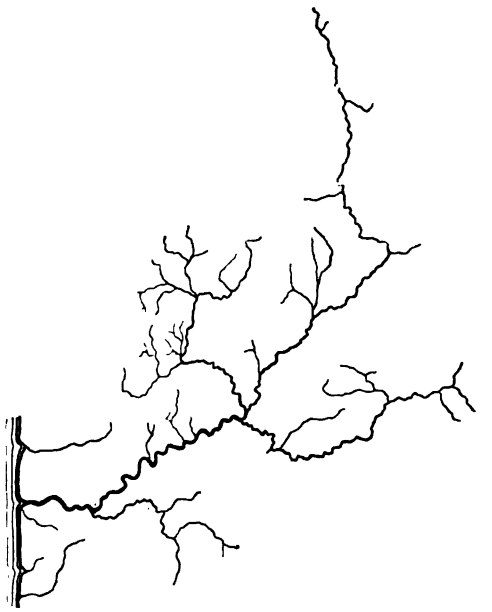
HOW THE RIBBLE BEGGARED ITS NEIGHBOURS—I.

scored by frost or rains, but presents a smooth, even surface. Gradually the forces gnawing at the rocks discover lines of weakness, and the waters begin to run in defined courses (Fig. I). Tributaries are formed which flow into the main streams, and still the three young rivers,



HOW THE RIBBLE BEGGARED ITS NEIGHBOURS—II.

pursuing independent paths, enter the sea by different mouths (Fig. II.). Now let us suppose that one of the rivers—R, for example—possesses some advantage over H and C. It cuts a deeper channel. This gives the tributaries a steeper fall, and they cut back more effectively than those of H and C. Finally, one of the tributaries of R succeeds in reaching the main stream of H, whose head waters are captured and diverted along the tributary to join R. Similarly a tributary on the left bank captures the head waters of C, and the valleys cut out by H and C below the point of capture are left streamless, or only a mere trickle is formed by



THE RIBBLE AS IT IS TO-DAY—III.

the scanty drainage from the slopes on either side (Fig. III.). The last diagram is copied from a map of North Lancashire, and gives the present courses of three rivers—the Hodder, the Ribble, and the Lancashire Calder.* Standing at the elbow of capture of the Hodder, and looking seawards, we have a broad valley in front of us through which a tiny stream flows. It does not fit the valley, but meanders in tiny curves inside a valley with swings which correspond to a much larger river. Similarly from the elbow of capture of the Calder we have an open valley towards the sea practically streamless.

* The coast-line given in the diagram does not follow the present outline of the shore. Changes have taken place since the events described above happened.

There can be no doubt that the events here shadowed have actually happened, and the Ribble has taken advantage of its superior powers to beggar its neighbours. Examples of this kind of river piracy might be quoted in great numbers from among our English rivers. One or two must suffice. We have reason to believe that at one time the Yorkshire rivers having their origin in the Pennines—the Swale, Ure, Nidd, Wharfe, Aire, Calder, and Don—emptied themselves into the North Sea by separate mouths. Along the Vale of York, where the rocks are softer than those of the Pennines or East Yorkshire, the Don sent up a tributary and successively captured the rivers to form what is now the Ouse. Again, the Thames once had its origin in the high lands of Wales, and the Severn has beheaded it. That is why the small brooks which join to make the infant Thames flow through valleys with swings altogether out of proportion to the existing conditions.

THE VICTORIA FALLS ON THE ZAMBESI.

From this we see that the present courses of our English rivers have not been determined by chance, but are the results of the working of certain well-known laws. They have been evolved by processes of natural selection. The best favoured and strongest have survived, while the weaker ones have perished in the struggle for existence.* It is evident that as rivers are constantly bringing material from the high grounds to the sea, the mountains are in process of being destroyed. We can imagine that by long-continued action they may be levelled down to form a plain but little raised above the level of the sea. Over these plains streams would flow in a feeble condition, as though in the last stages of decay. Now let us suppose that the plain were raised by earth movements to form a plateau, or, what comes to the same thing, so far as we are concerned, that the sea level were to fall and leave the plain elevated above the new sea level. This would give the rivers a new lease of life. At first they would tumble over the sea cliff as cascades, and then, gradually working back through the plateau, a new period of levelling would be commenced.

That is the story of the Zambesi and the wonderful Falls discovered by Livingstone in Central Africa. The Upper Zambesi flows sluggishly through a great plain only a little below the surrounding country. Then it falls over a great cascade 400 feet deep into a gorge which continues for many miles towards the coast. Similar features are to be seen in other rivers in Africa, and even in

* We must, of course, not overlook the fact that the control of streams has been affected by other geological considerations, more particularly by events which happened during the Glacial period. At that time a large portion of the British Isles was covered with a mantle of ice. The normal drainage was disturbed and in some cases permanently changed.

our own country. The return of youthful conditions makes them once more active agents of destruction, and, given time enough, the land will again be reduced to a low, featureless plain.

In these papers I have frequently spoken of rivers in terms usually applied to living things. No other terms but birth, youth, maturity, old age, decay, and death seem to apply when dealing with the life-history of a stream. But the words we have applied to an individual stream seem to have a wider meaning. Biologists say that the life-history of an individual outlines the history of a people; so, in rivers, the beginnings reproduce the characteristics of a stream beginning life on the first emergence of the land from the sea; the middle portion of a river reminds one of the conditions we see in streams well established; and the sluggish current of a river on nearing its end is seen again in an old river which has done its work in degrading the land and shows all the signs of extreme old age.

J. LOMAS.

HOW TO KNOW THE WILD FLOWERS

By the REV. H. PUREFOY FITZGERALD, F.L.S.
With Photographs by HENRY IRVING

THE FLOWERS OF THE WATER-SIDE—I

A RAMBLE which leads through moist meadows, along the sides of a stream or by the shores of a pond or lake, will be sure to introduce us to a number of plants which will not be met with elsewhere. The very nature of the soil in which they grow helps to give a wealth of bloom, and a goodly display of foliage, and tends to make these water-side wild gardens haunts of great joy and pleasure to the lover of flowers.

MARSH MARIGOLD

Looking like a giant Buttercup, the Marsh Marigold (*Caltha palustris*) is to be found in bloom in moist spots from March to June. Though belonging to the same family, it differs from the Buttercups in possessing no petals; the large, golden cups are really composed of five coloured sepals. The stems are somewhat stout, and the leaves are heart-shaped at the base, of a very deep, glossy green, and more or less round, increasing in size after the flowering season is over. In the centre of the golden cup, surrounded by many bright yellow stamens, is a head of carpels, which develop after fertilisation, each one bearing several seeds. The name *Caltha* is derived from the Greek *Kalathos*, signifying a cup. There are many local names for this plant; among them may be mentioned King-cup, Drunkards, Marybud, Meadow Bouts (from the French *bouton d'or*), May Blob.

WATER RANUNCULUS

The surface of ponds in the spring is often to be seen covered with the blossoms of the little Water Crowfoot, which in shape and form will be noticed to be the same as the Buttercup flower, but with white petals instead of yellow. On examination, the leaves of several plants will be observed to differ considerably; the floating leaves are, for the most part, round or kidney-shaped, while those on the submerged portions of the plant are cut into very fine, hair-like segments. In one plant (*Ranunculus hederaceus*) these cut leaves are not to be found, for it grows only in shallow water and on mud banks; but there are so many varieties of the kind that bear both forms of leaves that they may, for the beginner, be classed under one heading, *Ranunculus*

THE MARSH MARIGOLD.

aquatilis. None of the Water Crowfoots possesses the acrid taste of the Buttercups, therefore we presume that this property has been developed by the latter to protect them from being eaten by cows and other animals.

YELLOW IRIS

The Yellow Flag or Iris (*Iris pseud-*

WATER CROWFOOT.

acorus) is one of the most striking of all our wild flowers; its group of long, sword-like, pale green leaves, and its head of bright yellow flowers, will always catch the eye of the passer-by. The rootstock is thick, and grows in a horizontal position, throwing off the stems and leaves; it is very astringent and acid to the taste.

YELLOW IRIS.

Two or three bright yellow flowers appear on the flowering stem from a large sheathing leaf or bract, and if one of these be pulled carefully to pieces, it will be found to consist of nine portions. Since both the sepals and petals are coloured, the whole of the coloured flower is called a perianth; the three large, spreading portions (which give the name Flag) alternate with three smaller, upright inner segments. Over the larger segments there are three petal-like stigmas (the female parts), which serve as a covering to the stamens.

The Yellow Iris flowers towards the end of May and continues to do so throughout June.

Iris is the Greek for a rainbow, and the name was given to this group of plants on account of the many colours which are to be found among members of the genus; the name *pseudacorus* means "resembling the Sweet Sedge." The local name "Segg" is a corruption of sedge, and comes from the Anglo-Saxon word *segg*, meaning a small sword, from the shape and sharpness of the leaves. This plant is the original of the *fleur-de-lys* in the arms of France.

The Stinking Iris (*I. fœtidissima*), which is found in the hedges, is a smaller plant, and bears violet blue flowers; on being bruised it emits a somewhat disagreeable smell, though it is said by some to resemble the odour of roast beef.

is so handsome as *M. palustris*. One of the legends concerning the name is as follows: A knight and his lady-love were strolling along the banks of a stream, where the plant was bright with its turquoise blue flowers. When the lady

FORGET-ME-NOT.

FORGET-ME-NOT

The Forget-me-not (*Myosotis palustris*) will not call for much introduction, for its garden descendants are well known, and it is a general favourite. The common form is found growing in moist meadows and ditches and other like localities, and flowers abundantly during the whole summer.

The stems are rather weak, usually from twelve to eighteen inches high, bearing a long raceme of flowers of a clear, bright blue colour, with yellow eyes. The leaves are to be found with or without hairs, the latter form giving the name, Myosotis, from two Greek words meaning Mouse's ear. All the petals are joined together, forming the corolla, which varies very much in size according to the situation and the variety. Several kinds of Forget-me-not are to be found growing away from the water, but none of these

expressed her wish for some, the knight rushed into the stream and plucked them, but was carried away by the eddy after casting the blossoms at her feet, exclaiming "Forget me not."

MEADOW SWEET

The tall stems of the Meadow Sweet (*Spiræa Ulmaria*), crowned by the creamy, foam-like heads of flowers, are striking objects growing in damp meadows and on the banks of ponds and ditches. This plant belongs to the Rose family; the stem is usually of a reddish colour, about three feet high; the leaves are pinnate, the terminal leaflet being divided into three others, all of them green above and somewhat whitish and soft with down underneath. The small flowers are very numerous and strongly scented, the odour resembling that of almonds. This scent acts in the place of

MEADOW SWEET.

COMMON SKULLCAP.

honey (of which there is none) in attracting insects. The flowering season extends from June to August.

COMMON SKULLCAP

Another member of the *Labiatæ* to be found growing in moist spots is the Skullcap (*Scutellaria galericulata*), but it is difficult to say what is the origin of the common name, for there is no resemblance to a skull. The branching stems spring up from a creeping root-stock, growing nearly a foot in height; the leaves have scarcely any stalks at all; they are arranged in alternate pairs up the stem, and from the axil of each leaf a flower is produced; these flowers all turn to one side and are of a bluish colour. The lips of the corolla are very nearly closed. This seems to be for the purpose of admitting insects of a certain size only, for there is an arrangement inside by means of which the pollen, which has fallen out of the anthers, will be displaced and showered down on the back of the small insect as it pushes its way through in search of nectar, and which is carried by it to another flower.

WATER PLANTAIN.

The Lesser Skullcap (*Scutellaria minor*) is a much smaller plant, bearing small pink flowers; it is much less common in England. Both these plants flower throughout the summer.

WATER PLANTAIN

The photograph of the Water Plantain (*Alisma Plantago aquatica*) shows the appearance of the plant in the early seeding stage after it has flowered. The large leaves, all springing from the root, and

the tall, loosely panicled flower stem will readily serve for identification. The flowers themselves, borne throughout the summer, are somewhat small, of a pale rose colour; the perianth has three small outer portions and three larger inner ones, resembling petals; the six stamens each have two honey glands, one on each side of the base.

H. PUREFOY FITZGERALD.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.
Author of "Wee Tim'rous Beasties," etc.

THE SHORT-TAILED MEADOW MOUSE.—I

SHORT-TAILED FIELD MOUSE. FIELD VOLE. COMMON VOLE.

With Photographs by the Author

I HAVE come across a delightful Suffolk name for this beastie, one of those impetuous mother-tongue names which it seems almost sacrilege to print. Suffolk is rich in such. "Ranny-nose," the Shrew Mouse, for instance (they speak, too, of a "ranny-nosed" plough), "Fuzz-tail," the Stoat, "Mouse-hunt," the Weasel, "Pick-cheese," the Tit Mouse, "Tittereen," the Gold-crest, "Hodmadod," the Snail—fair samples all of a speech which is dying of education, but which yet has sufficient strength to speak simply of "Mouse Bats" and "Rat Bats," and to call the Meadow Mouse a "Mogger."

"Mogger" is more subtle than the others; yet no one who knows the animal can miss its meaning, while for those who do not know the animal the sound of it should almost suffice.

In the Short-tailed Meadow Mouse — markedly in the allied form which is peculiar to the Orkney Islands — we find the pure Meadow Mouse type. We leave behind the bold, round, staring eyes, the outshot ears, the fined extremities, which have characterised the species already dealt with; and find, in place of these, their opposites, small, beady eyes, ears hidden in the fur, stub tails, and blunted noses. The Meadow Mouse is the true Mouse compressed: he is Dutch-built. Nor has Nature contented herself with compr ssing his form: she has compressed his character. The Meadow Mouse has the lymphatic temperament; he is incurious; he lacks ambition; he potters round his birthplace. He may creep the length of the hedge-row timidly, but he will seldom work through it, nor can he scale it. His world is bounded by familiar grass stems, and with these he rests content until there comes a time when, all things combining to favour his increase—mild winters, excess of food, excess of cover, and a tem-

"MOGGER."

porary disturbance of Nature's balance —he multiplies, with amazing swiftness, into a plague.

THE SHORT-TAILED MEADOW MOUSE FEEDING.

Plagues of Meadow Mice (or some closely allied species) date almost from the dawn of history.

We read in the Septuagint version of 1 Samuel v.–vi.: "And the hand of the Lord was heavy upon Ashdod, and brought (evil) upon them, and boiled over upon them in their ships, and mice sprang up in the midst of the land . . . . and the ark was in the field of the strangers seven months, and their land boiled over with mice."

Herodotus recounts how Sethon, a priest-king of Egypt, was successful in checking the invasion of Sennacherib, King of Assyria, about 700 B.C. Sethon had imprudently snubbed the military caste, with the result that, on the appearance of Sennacherib, he found himself without an army. This sent him in great distress to the temple of Hephaestus, and there he had a vision of the god, who cheered him with a promise that he would find him allies. Relying on this promise he led out a mixed force of "shopkeepers, artisans, and loafers" to battle with Sennacherib.

The Greek text proceeds: "And when they reached that place (Pelusium), Field Mice were poured upon their enemies in the night, and they gnawed into their quivers and into their bows, moreover they gnawed into the hand-straps of their shields, so that when they fled on the morrow many perished for want of weapons. And now this king stands in stone in the temple of Hephaestus, holding a mouse in his hand, and saying, as the inscription shows, 'Whoso looks on me, let him be blessed.'"

The Greeks would seem to have favoured another deity. "Sminthos" is a word used by Æschylus for "mouse," and it is possible that Apollo Smintheus, mentioned in the Iliad, may mean Apollo the Mouse-killer, or Lord of the Mice.

We find distinct references to an early mouse-plague in Italy, both in Ælian and in Diodorus. Ælian's version is: "The incursion of a horde of Field Mice (by the gods no light matter!) drove certain of the people of Italy from their native place, and made exiles of them by ruining their crops and pasturage, just as drought or frost or other inclemency of weather would do—part the mice shaved close to the ground, and part they cut through the roots of."

It is noticeable that in all these cases the Greek clearly implies that the appearance of the mice was sudden as well as overwhelming. This suddenness seems to have been characteristic of mouse-

THE MEADOW MOUSE'S TUBE.

The opening has been cleared and the grass on the near side cut down to show the arch of the tube above ground level.

CHARACTERISTIC ATTITUDES
OF THE SHORT-TAILED MEADOW MOUSE.
The lower picture shows a combat.

plagues from Biblical times to the present day.

Holinshed, writing of our own country in Queen Elizabeth's reign, says: "About Hallowtide last past (1581), in the marshes of Danesey Hundred, in a place called South Minster, in the county of Essex . . . . . there sodainlie appeared an infinite number of mice, which overwhelming the whole earth in the said marshes, did sheare and gnaw the grass by the roots, spoyling and tainting the same with their venimous teeth in such sort that the cattell, which grazed thereon, were smitten with a murraine, and died thereof, which vermine by policie of man could not be destroyed, till at the last it came to pass that there flocked together such a number of owles, as all the shire was able to yield, whereby the marsh-holders were shortly delivered from the vexation of the said mice. The like of this was also in Kent."

The report of the Departmental Committee appointed by the Board of Agriculture in 1892, to inquire into a plague of Field Voles in Scotland, from which the above quotation is immediately derived, forms a very interesting and a very cheap book of natural history.* The area damaged in this particular instance during the years 1888–1891 amounted to not less than sixty miles in length and from twelve to twenty miles in breadth. As is usually the case in matters connected with land, the Committee was confronted with the rival claims of two distinctly opposed interests. On the one hand, in the interest of the farmers, witness after witness testified that the plague was solely to be accounted for by the game-keepers' wanton destruction of winged and ground vermin. On the other hand, in the interest of the game preservers, there was good evidence to show that the destruction of vermin had not been excessive, and that the plague was solely to be accounted for by a succession of mild winters and an abnormal growth of food and cover for the mice.

The finding of the Committee that the plague was due to a combination of all these causes, and that a prompt organisation of the farmers to stamp it out in its early stages would probably have greatly mitigated its severity, will hardly be disputed by anyone who reads the evidence impartially.

In the course of the inquiry some interesting information with regard to what may be called the climatic cause of the outbreak was obtained. There was indisputable evidence to show that the seasonal conditions which favour a mouse plague are—a wet autumn, a mild winter, and a dry spring, in immediate succession.

A wet autumn results in a luxuriant growth of rough grass, which serves as cover for the mice, and at the same time provides them with unlimited food. By a "mild" winter is meant the absence of black frost of sufficient severity to search their winter burrows. Neither snow nor rain, apart from actual flooding, has any terror for them. Both in this country and in higher latitudes they move freely in tunnels underneath the snow, counting the snow as so much additional cover, while a soft, damp soil in general attracts them. In fact, they normally inhabit marsh-land by reason of its "roughness." A dry spring implies comfortable conditions for breeding, and that dryness of the nest which is essential to all young animals. Of these three favourable seasonal conditions I think that the first is perhaps the most important.

I have already referred to the timid, spiritless character of the Short-tailed Meadow Mouse, and my estimate of him is based, partly on my experience of a large number of captive specimens, and partly on certain observations which I was able to make on a small wild community. These observations commenced early in April, 1906, and extended over several weeks. The burrow was situated in the midst of a water-meadow, and the occupants had taken advantage of the roots of an old ash stump to save themselves unnecessary exertion. My first intimation that the stump—which scarcely rose above ground level—held tenants, was a momentary flash of brown. The distance was too great for me to determine its origin, but on the next occasion I approached more carefully and satisfied myself that I had a mouse to deal with. Then followed several stealthy ap-

*Obtainable through Wyman and Sons, Ltd., Fetter Lane, E.C. Price, 1s. 4d.

proaches daily, and, with the aid of a field-glass, I managed to see something of the daily round. The grass which surrounded the burrow was at the commencement of my observations quite short, and although I satisfied myself of the existence of two entrance shafts, each with a clear perpendicular drop of about nine inches, I could find no trace of anything in the nature of a run leading up to them, nor did I ever see the mice move more than a couple of inches away from them. They would often sit at about this distance to sun themselves, and, at intervals, performed their toilet, but, at the slightest sound or movement on my part, even though I was a dozen yards away from them, they would whisk about and vanish. I discovered later that they turned, flung themselves at the shaft, and dropped down it almost in one motion, and I have no doubt that this first clean drop often saves them from their enemies. A weasel, for example, though he could dive as quickly as the mouse, would waste a moment at the bottom in turning and getting his hind legs clear. So long as the grass remained short the mice never ventured to feed outside (no doubt they had a store in the burrow), but once it began to grow they commenced their characteristic surface runs, and presumably fed along them. These runs, when freshly made, are difficult to follow. They can best be traced by lowering and bending the head so as to catch the shadow of the displaced grass at a suitable angle. The run itself is usually on and not below the surface, and is completely screened by the lower portions of the grass-stems. By inserting a finger gently within it one is quickly convinced of its protective character, for one's finger becomes invisible.

DOUGLAS ENGLISH.

OLD ENGLISH GARDENS

By H. H. THOMAS

SOME gardens are like certain gardeners: they seem to be born, not made. And the old English garden is one of them. It would not be an easy matter to say how an old English garden should be made, for its most treasured attribute, its chief characteristic, is an indefinable charm—a charm so elusive that it is difficult to account for, and altogether beyond the power of the garden-maker to create. It has been said that in the making of a garden Time plays an all-important part, and in an old English garden Time plays the most important part of all: "touching crude colours to restful tones, glaring effects to subtle harmonies." There is an old-world atmosphere about the old English garden, an enchantment born of the happiest association of leaves and flowers, and these are beyond the power of man to furnish except in harmonious working with the softening, mellowing touch of Time that clothes even the commonest flowers with a halo of charm. It is strange yet it is true that one may spend days and hours in the most magnificent of gardens, planted with the costliest flowers which make brilliant colour masses that are the despair of the artist faithfully to portray, yet no appeal is made to that susceptibility to the presence of the beautiful in Nature which exists in all of us: the galaxy of colouring is wanting in subtle association, a sense of artificiality is all-pervading. One realises that the garden lacks that distinctive, that indescribable charm born only of clustering blossoms which have lived and loved together for many years. It is as though one compared the home life of the happy, thrifty cottager, the fond ties that exist between father, mother, sister and brother, linking one to another in a firm, close-cleaving affection, har-

monious and perfectly balanced, with the stilted form, the false atmosphere, the apparent goodwill and friendliness of the greetings of half-strangers in a society drawing-room, where an air of hypocrisy ruffles the surface calm, and unreality reigns supreme. There is as great a difference between the modern

Photograph by F. Mason Good, Winchfield

A WISTARIA-COVERED PORCH.

garden, where plants, raised in an artificial temperature, crowd each other in the beds and borders, and the old English garden where the plants have grown together from babyhood and thrive in perfect harmony, each content to play its own part in the making of a garden-home without encroaching on the rights of others.

An old English garden is most easily made with those commonly known as hardy border flowers, with Phloxes, Irises, Roses, Carnations, Pinks, and Picotees, with Pæonies and Pyrethrums, Lupines and Larkspurs, Lilies, Hollyhocks and Bell-flowers, for these thrive best when carefully planted and allowed to go their own way, undisturbed and unrestricted. Each soon finds its own level: although during the first few years some may need gently reproving and others tenderly nurturing, gradually they will come to blend into one harmonious whole, each filling its own allotted space and not interfering with its neighbour. Not everyone can hope to make an old English garden, a garden that shall be as part of one's life, a fount of joy in times of bright sun-shining, of soothing sympathy when days are dark. It is only those of us who are content to leave well alone, to let the plants go *their* way and not compel them to go ours, that are capable of guiding a garden to its fullest destiny and investing it with a charm that shall finally pervade it from end to end, and make of it a thing most beautiful. More gardens are spoilt through being continually disturbed than in any other way: possibly this is the reason one sees so few of those gardens which have come to be known as old English gardens, a title that signifies not merely a collection of plants, but a home of flowers in which sacred memories cluster about the leaves and petals, and the very air seems filled with a sense of rare delight.

The house itself has an important bearing on the garden, and especially on the old English garden: there are some houses around which it would seem impossible to make a garden of grace and charm—houses whose austere fronts and formal terrace walks are quite out of keeping with free-growing, old-fashioned flowers. Yet much may be done to bring the house into closer touch with the garden. Climbing roses, Honeysuckle, Ivy, Clematis, and other plants that love to cluster about barren, sun-kissed walls, must be trained to cover the brick and stone with fair leaves and fragrant blossoms, looking in at the window, clinging round the door.

Photograph by F. Mason Good, Winchfield.

COTTAGE AT STUDLAND, DORSET.

Photograph by F. Mason Good, Winchfield.

THE GARDEN, HOME PLACE, LIMPSFIELD.

There should be shrubbery borders at the foot of the house walls planted with sweet-scented Verbena, with bush Honeysuckle and Mock Orange, with Myrtle, Lavender, and China Roses. Then the house would seem to have a greater affection for the garden and be less likely to rob it of its charm.

window with as little compunction as it creeps up the house wall. One cannot help feeling a strong affection for such a plant as this: if only well and carefully planted it seems as though it could never do enough to reward you, and considers all obstacles as something to be covered with a delicate tracery of elegant leafage.

Photograph by F. Mason Good, Winchfield.

"A LEAF-ENCLUSTERED COTTAGE."

The effect of the house on the attractiveness of the garden is seldom realised. Who, after a glance at the creeper-covered, leaf-enclustered cottage shown in the illustration on this page, can doubt the influence of the house to make or mar the beauty of a garden? This is an ideal cottage around which to make an old-fashioned English garden. The garden should come near to the doors of the house, then the narrow borders and flower-fringed doorway would bridge the little gap, making the whole domain a delightful home of flowers. Even the roof itself should know the clinging Virginian Creeper that recognises no conventions, and climbs the chimney, covers the roof, and clings to the bedroom Even a cold north wall, where few flowering plants will thrive, has no terrors for this ubiquitous creeper, which clings as firmly to the shadowed bricks as to those well warmed by the sun.

But the Rose remains King of climbing plants: there is none to rival its profusion of blossom, its fragrance, homeliness and charm, and in the making of an old-world garden, climbing roses must cover the house walls with a galaxy of fairest blossom. The King of climbing plants is just a little fastidious, and droops and pines under neglect, but who, knowing the fascinating beauty that lies hidden within the prosaic green shoots, would be guilty of such bad gardening as to ignore the needs of the consort of the

"A GARDEN OF MEMORIES." Photograph by F. Mason Good, Winchfield

Queen of flowers? Even the most delightful among old English gardens owes a great deal to attention to small details, and of these the careful preparation of the soil is the chief, and to roses climbing the house the most urgent.

Even when well and carefully planted one thing still remains to be done if the climbing rose is to give of its best, and

Photograph by F. Mason Good, Winchfield.

GARDEN OF SHIPLAKE COURT.

that the most ruthless work of all. The shoots, even if 6 feet long or more, should be cut down to within 3 or 4 inches of the soil: then, and then only, is it possible to promote the growth of shoots that shall transform the bare walls into canopies of flower and foliage. And much the same treatment is needed by other climbing plants when first put out at the foot of the house or garden wall.

Wide borders of simple shape suit the old English garden best, borders in which the plants have plenty of room to grow and make wide masses of rich colour. Old-fashioned flowers, such as Lilies and Phloxes, Irises and Larkspurs, are best in groups: to rob them of each other's company is to spoil the appearance of the garden and to divest it of its chief delight. The pathways should be fringed with white Pinks and crimson Thrift, in front of the giant spires of Larkspur following closely on Lupines in rose and white and blue: Oriental Poppies, multicoloured Pyrethrums, Flag Irises, Gloire de Dijon and William Allen Richardson Roses, Cornflowers, Foxgloves, Violas and Pansies, should find a place among the early summer flowers; while Madonna Lilies bordering the grassy way beneath the pillared pergola would make, perhaps, the fairest sight of all, since they bloom with the roses.

But the old English garden is not made entirely with plants that are left alone from year to year: some old-world favourites are raised from seed and take the place of the spring blooms, carpeting with fair blossom ground that would otherwise remain bare. Such, for instance, as Candytuft, Sweet Alyssum,

Musk and Mignonette, Shirley and Iceland Poppies, Love-in-a-mist and Nigella, Musk Mallow and Venus' Looking-glass. All are delightfully easy flowers to grow, and so, above all others, are best suited to the old English garden, whence rebellious plants are barred. One simply sows the seed in spring, and removes the seedlings here and there when they cluster too thickly, and again the garden goes on its own wild way.

Photograph by F. Mason Good Winchfield.

IN THE FLOWER GARDEN, BELVOIR CASTLE.

Above all things, however, the old-fashioned garden should have a border full of fragrant leaves and sweet-scented blossom, of Bee Balm, Southernwood, Lads' Love, Lavender, Rosemary, Thyme, and Sweet Verbena, for such as these are the very soul of an old-world garden—these together with Cabbage Roses, the quaintly striped blooms of the York and Lancaster Rose, the pink and crimson Monthlies, the Cluster Roses, white Pinks and London Pride. Then the dark red and crimson roses must not be forgotten, for more often than not these have a full fragrance that is wanting in the paler sorts. Such, for instance, as General Jacqueminot, Sultan of Zanzibar, Duke of Edinborough, Duke of Wellington, A. K. Williams, and Fisher Holmes are indispensable in a garden that is destined to take its place among those honoured by the name of old English. They are as the breath of the garden, the spirit of its being, for enchantment rides on fragrant wings, sweet scents hide subtle charm. Thus if one would make an old English garden he should first take care that the prosaic foundation, without which the most exquisite superstructure cannot last, is not wanting. It should be firm and well laid, for the glory of the garden grows slowly, yet on a good foundation most surely as the years pass by. Then are chosen the most fragrant blossoms that sweet thoughts may come to one on the breath of the flowers, wafted like echoes from a fast fading, hallowed past. Some of these should be near the house windows that, morning and evening, noon

and night, there might come a message from the flowers bringing inspiration at working time, and even a glamour to your dreams.

The real old English garden is modelled closely on Nature's own wild garden of the fields and woods. Having chosen the most suitable spot for the various plants, one leaves them to the soft summer breeze, the cool night air, strength-giving sun and refreshing rain, that they may live their lives without further interference, conscious that in due time they will give of their best. Only when Time has made perfect the imperfections of man's work among the flowers can the old English garden be said to have reached its fullest beauty; then it is surpassed by none in grace and charm. There is something about it that speaks straight to the heart, casting an irresistible spell and bringing home to one the delights of a garden tended by Nature herself. A garden grown old is the most beautiful of all, and it is only by leaving the plants to the subtle skill of Nature and the fostering care of Time that a garden can grow to a perfect old age. Flowers continually disturbed lose their hold in the garden scheme; they strike a false note and mar the harmony of the whole. A sense of peace hovers over the garden that is old: the plants are treasured friends with which one has grown up: they are linked inseparably with the joys and sorrows which have beset the pathway of life. An indissoluble bond of fellowship binds them to us: with us they were young, with us they are growing old.

H. H. THOMAS.

Photograph by Pictorial Agency.

IN MISS H. PERRIN'S GARDEN AT TERENURE.

A POOL IN THE NEW FOREST.
From the Painting by A. C. Wyatt.

HOW TO KNOW THE BIRDS

By the REV. MAURICE C. H. BIRD, M.A., M.B.O.U.

With Photographs by
RICHARD AND CHERRY KEARTON

STARLINGS AND CROWS

WITH the hard and close-feathered Starling we get to a bird beyond the average *Passerine* size and approaching the Crows in shade and make. It brings itself continually under our notice in town and country by chattering from our chimney pots, breeding under our tiles, or industriously searching our grass plots for noxious grubs. A beautiful bird is the spring-time Starling, and cheery besides, as with crown feathers erect, drooping, quivering wings, and metallic-lustred plumage, he whistles, chatters, and sings—even in mid-winter should the sun be shining—mimicking meanwhile the strains of many other birds that are then silent.

The black body-colour is radiated with glossy green and purple reflections, each feather of the upper plumage being star-tipped with cream colour. As with the Blackbird, Swan, and other less well-known birds, the depth and clearness of colour in the Starling's beak varies with the season; the sexes when adult are almost equally bedecked with glossy sheen, but the young birds in first plumage are clad in sombre ashy brown, in which garb they assemble on the meadows and marshes by the middle of June, young and old congregating in vast flocks as the season advances. In the autumn the weight of their numbers roosting upon the reeds around our Broads plays havoc with the marshman's winter harvest.

MALE STARLING.

FEMALE STARLING.

and later on, when thousands betake themselves to perch amongst the evergreen plantations, their presence is generally voted a nuisance, not so much on account of the babble of their chatterings as of the pestilential perfume of their droppings. Some compensation for the nuisance and damage caused by their nightly numbers is to be gained from watching their marvellous evening aerial evolutions, which are continued for some half-hour ere sunset, above and around their much-fought-for perching places.

ROOKS' NESTS.

Perhaps the most distinctive habit of the Starling, however, so far as the roadside naturalist is concerned, is the beneficent service performed by it to the fleecy flock. The larger Jackdaw and Magpie upon occasions also act as sanitary inspectors of living cattle, but should a bird about the size of a Thrush be seen demurely perched upon the broad back of a complacently reclining or grazing sheep it may be taken as practically certain that the bird is a Starling, intent upon ridding the sheep of unwelcome guests. It is, perhaps, prompted thereto by the proverbial fellow-feeling, for the Starling itself is a prey to insect parasites, to which fact may be accounted its winter bathing in roadway puddles, from which the passing horse

YOUNG CARRION CROWS.

hoofs have partly removed the icy covering.

The initial difficulty in dealing with the Crow family is to differentiate between a Rook and a Crow. The Hooded or Grey Crow—specially partial to the neighbourhood of the sea-coast, upon which it delights to scavenge—is easily to be distinguished from its cousins by its costume, but the Black or Carrion Crow so closely resembles the Rook in many respects that the two are often confounded. In the hand the two species may at once be identified by turning back the body feathers, when it will be seen that their bases in the Crow are a dull white, whilst in the Rook they are dark grey. The adult Rook has the space between the eyes and beak white, warty and bare of feathers, whilst in both Black and Hooded Crow it is covered with bristly feathers. The two Crows are rather larger and heavier-looking birds, and with harsher voices than the Rook, and they are rather solitary than gregarious in their habits, especially in the breeding season; they never build in colonies as do the Rooks. In strictly corn-growing districts the latter birds entirely disappear from June until harvest time, taking their young to the grass lands where worms and the larvæ

of Click Beetles (wireworms), Daddy Long-legs, and Cockchafers are come-at-able. In autumn, where oaks abound, Rooks may often be seen plundering the trees of acorns; they are equally partial to walnuts, and where potatoes are grown as a field crop they are apt to levy toll upon the tubers.

Both Rooks and Crows are terrible egg thieves, but the former are not so destructive to the young of other birds and animals as are the Carrion Crows, which I have known to attack young lambs, and the neat way in which both they and Grey Crows will turn the skins of rats and rabbits inside out in order to pick the bones is surprising.

CARRION CROW'S NEST, WITH YOUNG.

At a distance the Jackdaw is much like a Grey Crow in miniature so far as plumage is concerned, but on closer inspection the black and the grey feathering will be found to be not quite similar either in tone of colour, or in distribution about the body. The smaller bird has the iris white instead of dark hazel, and Jack's note will soon betray his species, for the Daw is a proverbially loquacious bird.

Rooks, Crows, and Jackdaws are all fond of gyrating—sweeping, circling, and tumbling about in the air, especially on still autumnal days; though when these manœuvres are indulged in they are said (sometimes of course rightly) to presage stormy weather.

In October numerous Crow birds may be seen trooping over from the Continent for many days together. On their arrival on our eastern coast they leisurely work their way inland, flying low down meanwhile.

The long-tailed black and white Magpie needs no further description, as it cannot be mistaken for any other bird. It is sly and crafty to a degree, and is never allowed to multiply in game-preserving

districts because of its egg-thieving propensities. Next, perhaps, to its strongly contrasted colours, the most striking peculiarity in connection with the Magpie is the monstrously long hops by which it seems able to progress on the ground with a minimum of apparent exertion.

Whilst Rooks and Crows build large and clumsy open nests, the Magpie covers its deeper-cupped nursery with a dome of thorny sticks, whereas the Jackdaw usually builds in holes of trees, masonry, or sea-cliffs, and, though rarely, in rabbit burrows.

The eggs of the Jackdaw assimilate to those of the rest of the Crow family, in that they are of a pale blue ground-colour, but spotted and blotched rather than streaked with superimposed (almost black) markings. Now it is very unusual

A JAY FEEDING HER NESTLINGS.

for birds breeding in holes to lay such highly coloured eggs, and the fact that the Jackdaw does so is accounted for by the supposition that it is in a transition stage so far as nidification is

JACKDAW.

concerned, a suggestion which is supported by the fact that both domed and open nests built in trees by this species have been found.

The Jay, with erectile crest, black moustaches, pale vinous brown body feathers, black and white wings, and black tail, is more strictly a bird of the woods than any other representative of the Crow family. It seldom shows itself in the open, and as infrequently allows a sufficiently near approach for the beauty of its lovely black-barred, azure blue wing patch to be duly admired. At the slightest alarm, with or without a harsh scream, it hurries off with wavy flight, exposing to view meanwhile the white rump and upper tail coverts which may act as a flag to be followed by all the less wideawake Jays in the neighbourhood.

Jays are very inquisitive, and by trading upon this very human trait in their characters, these handsome but wary birds may easily be studied at close quarters. A kitten (the lighter in colour it is the better) should be taken into their plantation home, tied up in a clear place under the trees and there left; the observer should then conceal himself amongst the surrounding brushwood and watch for developments. When pussie begins to mew for company, the Jays will soon arrive to inspect and talk over the little stranger, showing themselves off meanwhile to great advantage.

Inimical as the Crow birds doubtless are to the interests of gamekeepers for a month or two in the year, they also act as useful alarums when other poachers, biped or quadruped, are on the prowl.

YOUNG JACKDAW.

Thus the alert and garrulous Jays are all on the chatter so soon as the preserves, which they inhabit on sufferance, are invaded by strangers in daylight, whilst the restless Rooks are sure to give noisy notice of trespassers by night in the coverts where they roost.

MAURICE C. H. BIRD.

THE LIFE OF THE SEA-SHORE

By F. MARTIN DUNCAN, F.R.P.S.

Illustrated with Photographs by the Author

THE SHELL-DWELLERS

"See what a lovely shell,
Small and fine as a pearl,
* * * *
Frail, but of force to withstand,
Year upon year, the shock
Of cataract seas that snap
The three-decker's oaken spine
Athwart the ledges of rock."

TENNYSON'S exquisite lines are vividly recalled to us as we stoop to pick up a frail, daintily shaped and tinted shell cast up at our feet by an incoming wave. So fragile, and yet so wonderfully built that it can withstand the rough tumbling of the surf. The shell-dwellers form a very important portion of the life of the sea-shore; and whether we only examine the beautiful shell-dwellings, or watch them when attached to the curious inhabitants responsible for their construction, they are of the greatest interest and beauty. As we look through drawer after drawer of a collection of shells, though their beauty of form and colour arrests our attention and calls forth our admiration, we can learn but little of the why and wherefore of those varied shapes, or of the animals of which they once formed a part. If we are true lovers of Nature, the sight of these shells sets us longing to be down on the sea-shore, wandering over the golden sands, and peering into the depths of the rock pools, striving to find out what the creatures that form these wonderful dwellings are like.

"Did he stand at the diamond door
Of his house in a rainbow frill?
Did he push, when he was uncurl'd,
A golden foot or a fairy horn
Thro' his dim Water-world?"

THE PECTAN, OR SCALLOP.

All round our coasts the shell-dwellers abound, so that when on a visit to the sea-shore, one cannot fail to meet with specimens. Some, like the Oysters and Mussels, lead a sedentary life, while others lead a more or less active existence, crawling over the rocks and weeds, or burrowing in the sand. One of the largest of our shell-dwellers, although not strictly belonging to the sea-shore, but rather to the region beyond low-tide mark, is the Common Scallop, or Pectan. Its shell, however, is a very familiar sea-shore object, cast up by the waves after a storm, and frequently having upon its upper surface a luxuriant growth of Garland Polypes, Moss-animals, etc. The shell of the Scallop is composed of two parts, or valves, quite dissimilar to each other in appear-

ance, one being flat, the other convex. The animal itself is a remarkable creature, and has a very curious method of

PECTAN OR SCALLOP SHELL, WITH ACORN BARNACLES ATTACHED.

locomotion, for when it wishes to travel it smartly opens and closes the valves of its shell, thereby causing a rapid expulsion of water, which drives it backwards. The Scallop is a veritable Argus as regards eyes, possessing somewhere between sixty and seventy. These numerous eyes, moreover, are well-developed organs, and are arranged in a double row, like brilliant, tiny, green beads, upon the edges of the fleshy envelope or "mantle" that encloses the body of the Scallop.

The Queen Scallop is smaller, and differs considerably in general appearance from the Common Scallop, both the valves of its shell being convex and more firmly convoluted. A small Scallop, called *Pectan varius*, is well worth hunting for, on account of the beautiful form and colour of its shell, the latter being very varied, from pure white to a fine red-brown.

A handsome and interesting shell-dweller is the Solen, or Razor-shell, which has gained its popular name from the shape of the two valves of its shell, which united along one edge somewhat resemble a razor-case. These valves have a highly polished outer surface, marked with beautiful gradations of orange, brown, green, and purple colours; while within they are an exquisite pearly-white, through which the outer markings show. The valves are thin, and bent to form a cylinder open at each end. The Solen lives in the sand near low-tide mark, at a varying depth of a few inches to a couple of feet or more, in an upright position, and its presence may be detected by little hollows, somewhat resembling keyholes, in the sand. If we carefully watch one of these openings, and make a gentle movement on the surface of the sand near to it, we shall see a little jet of water thrown out from time to time. The fishermen, who use the Solen for bait, watch for the little jet of water, and at once plunge a barbed iron wire into the sand at the spot from which the jet issued, and generally succeed in impaling the unfortunate mollusc.

A simple method of obtaining an uninjured specimen for examination is to sprinkle a small quantity of salt upon the holes in the sand. The salt soon penetrates down the hole, and reaches and irritates the ends of the tubes or syphons of the animal, causing it immediately to rise in the sand. The

THE ORMER (INNER SURFACE OF SHELL).

moment it appears at the surface the Solen must be swiftly seized, for if alarmed it will dart back into its burrow, and then no amount of salt or

anything else will induce it to come out again.

If we are lucky, and capture the Solen, we may witness the remarkable and rapid manner in which the creature burrows. On being placed on the sand, the Solen at once protrudes a flat-shaped foot which ends in a point. It then with ease proceeds to drive this singular organ into the sand, and bending the pointed end into the shape of a hook, acquires a sufficient hold to drag the cylindrical shell into an upright position. The foot is then unbent, elongated, and again forced downwards to a depth of one-half to two-thirds of the length of the shell, and then the foot completely changes its shape. Without diminishing in length, it becomes cylindrical, swelling out near its extremity into a fleshy globe, which becomes securely embedded in the sand. Then by shortening that portion of the foot which is situated between the globular swelling and the shell, the latter is drawn downwards, and this process, being rapidly repeated, the creature buries itself with astonishing velocity.

1. NATICA, OR SEA SNAIL.
2. THE CHITON, OR ARMADILLO-SHELL.

On all rocky shores the Limpets abound, and this in spite of many foes. On a lonely stretch of rock-strewn shore one may watch one of the sea birds, called the Oyster Catcher, at work, knocking the Limpets off the rocks by sudden, well-directed blows of its punch-shaped bill, and then scooping out and devouring with evident relish the fleshy parts of the unfortunate shell-dwellers. Another foe of the Limpet is the Dog-whelk, which lives on the shore from close to high-water mark down to and beyond low-water mark. If we look about carefully amongst the rocks we are pretty sure to find a Dog-whelk perched upon a Limpet, engaged in the process of drilling a neat hole through the shell of its unfortunate and helpless victim. When the Dog-whelk wants a meal, it climbs up on to the crown of the Limpet shell, and with the aid of its file-like tongue proceeds to rasp a hole through the shell, and then inserting its protrusile mouth, literally eats the Limpet out of house and home.

Though of humble exterior, the Limpet is in its way a really remarkable creature. The tenacity with which it clings to the rock upon which it is resting is proverbial, and experiments have proved that it takes about a seventy-pound pull to dislodge a fair-sized Limpet when once the creature has got a firm hold. Inside its mouth it has a long, ribbon-shaped organ, called the radula, or tongue, which has many teeth upon its surface, and is used by the Limpet with a rasping movement when feeding. There are about 160 rows of teeth on this curious tongue, and as each row has twelve teeth, the Limpet has about 1,920 teeth in all.

The familiar Periwinkle is also the possessor of a remarkably long tongue, furnished with some 500 to 600 rows of teeth, and it is with this wonderful organ that the Periwinkle rasps away at the seaweeds which form its staple diet.

Frequently to be met with on the rocks at low water is a curious shell-dweller,

which looks rather like a long, flat Limpet, but on closer inspection is seen to have its shell arranged in eight pieces or bands across its back. This is the Chiton, and

COWRIE AND VENUS SHELLS.

when detached from the rock the creature has a curious habit of rolling itself up like an armadillo, so that it is sometimes known as the Armadillo-shell. The eight divisions of the shell are so arranged that the pointed posterior edge of each overlaps the one behind.

The large and handsome Ormer (*Haliotis tuberculata*) abounds on the shores of the Channel Islands, and full-grown specimens measure about four inches in length by three inches in breadth. Its beautiful iridescent shell is frequently to be seen in seaside "curio" shops, and is one of the delights of every collector.

The Sting or Rock Winkle, like the Dog-whelk, preys upon its fellow shell-dwellers, and frequents the pools near low-tide mark and the deeper water beyond. It is one of the many foes of the Oyster fisherman, for it delights to drill a hole through the shell of the Oyster and regale itself upon that succulent mollusc. In the time of the Romans a beautiful purple dye was obtained from a species of Rock Winkle, the small shells being bruised in a mortar; and on the Tyrian shore and the coast of Morea large heaps of these crushed shells, together with the old rough stone mortars, are still to be seen.

"Devour and be devoured" is very much the order of life amongst the shell-dwellers, and the pretty little sea-snail Natica is no exception to the rule. Feeding largely upon small Mussels and similar molluscs, the Natica is in turn greedily devoured by the Cod and Haddock.

The Cockle, which frequents sandy, gravelly shores, is a great gymnast, for by smartly projecting its foot against the ground it can leap a distance of five or six yards. Where Cockles abound an extraordinary sight may be witnessed as the tide begins to rise, for then the Cockles, which have been safely hiding in the sand, emerge in large numbers and begin to leap down the shore towards the incoming tide. The Prickly Cockle (*Cardium echinatum*) is well worth seeking for its handsome shell. It is a cousin of the Common Cockle, and is to be found in similar situations on the shore.

A shell-dweller that has an almost world-wide distribution is the *Trochus*, or, to give it its two popular names, the Hoop or Top shell. The animal lives in the pools at about low-water mark, and has a very handsome pyramidal-shaped shell, with a nearly flat base.

The beautiful, lustrous white Ladder-

THE PRICKLY COCKLE.

shell, or Wentle-trap, is another shell-dweller that frequents the rock pools at low-tide mark. The delicate spiral shell is turreted and many-whorled, and is further ornamented with numerous transverse ribs. A living specimen should

always be handled with care, as the animal, when angered or molested, has a habit of discharging a purple staining fluid.

LADDER-SHELL, OR WENTLE-TRAP.

The Scaphander, or Boat-shell, is a carnivorous shell-dweller that delights to feed upon the inhabitants of the slender, tubular-shaped Tooth-shells. It is rather a handsome creature, with an oblong convoluted shell, and is the proud possessor of a remarkable and somewhat complicated shelly gizzard. It frequents sandy ground from about low-water mark to a depth of fifty fathoms.

On rock-strewn shores, seeking the shelter of the overhanging rocks in the pools, we may find the pretty little Cowrie (*Cypræa Europea*), a type of a family of shell-dwellers comprising some 150 species, with an almost world-wide distribution, which attain their greatest size and beauty in tropical seas; they are represented in past geological formations by about 84 species. The Asiatic Islanders use a Cowrie (*Cypræa annulus*) to adorn their person, threading the shells so as to form elaborate necklets, and also use it for purposes of barter. The Money Cowrie (*Cypræa moneta*) is used in barter very largely by the islanders in the Pacific and Eastern seas, though not to the same degree as in the early days of their commercial relationships with European traders.

To give anything like a detailed description of all the shell-dwellers that frequent our shores and tidal pools would fill half a dozen portly tomes, and therefore the above brief account of some of the more striking or familiar forms must suffice. Their wonderful deep-water-loving cousins, the Octopus and Cuttlefish, I have very fully described in my book on the "Denizens of the Deep." There are, however, two most interesting molluscs, frequenters of our tidal pools, which we most certainly should try to find during our rambles along the shore; one of them is called the Sea-Hare, and has only a rudimentary shell; and the other, the pretty little Doris or Sea-Lemon, has no shell at all.

The Sea-Hare represents a transitional type between the true shell-dwellers and their shell-less cousins, and has quite a rudimentary, oblong, translucent shell, which is partly hidden in the folds of the large fleshy lobes down each side of the body. It is a strange-looking animal, rather slug-like, with a long neck, and has four tentacles upon its head, the dorsal pair somewhat resembling the ears of a hare. It is from these ear-like tentacles that the creature has gained its popular name. Formerly, the Sea-Hare, on account of its grotesque shape and the purple fluid which it discharges when alarmed or

THE BOAT-SHELL WITH ITS CURIOUS SHELLY GIZZARD-PLATES.

irritated, was an object of much superstitious dread, for the fluid was believed to be a deadly poison and to produce indelible stains. This old-world myth is

perpetuated in the Latin name of the Sea-Hare, *Aplysia*, which literally means unwashable. Although a perfectly harmless creature, it is advisable to handle a living Sea-Hare with caution, for not only does the animal discharge its purple fluid, but also may have a pungent odour, which is very difficult to remove from the hands.

The Doris has no shell at all. It is a pretty little oval creature, and is in shape and colour somewhat like a lemon that has been cut in half lengthwise. It is from this appearance that the little animal has gained its popular name of Sea-Lemon; its Latin name, *Doris*, meaning a sea-nymph. The Doris is to be found on most rocky coasts, crawling over the rocks near low-tide mark, and is one of the very few animals that feed upon the sponges. So fond is it of devouring sponges, that on cutting a Doris open one is pretty sure to find its stomach crammed with sponge spicules, the absolutely indigestible portion of the sponges. During the summer months curious, whitish, gelatinous rosettes, some two inches in diameter, may be seen fixed in a rather conspicuous manner on the rocks in the tidal pools. The gelatinous ribbon of the rosette is divided into tiny spherical sacs, each containing four or five eggs of the Doris. If we examine under the microscope a portion of one of these rosettes when the young are just hatched, a very remarkable scene is presented to our view, for within each sac four or five young Dorids, each partially enclosed in a beautiful, transparent, Nautilus-shaped shell, may be seen swimming actively round and round. The presence of this transparent shell, covering the young Doris, is very remarkable, and interesting, for it shows us that the now shell-less adult Doris has descended from shell-bearing ancestors, and was in some past age probably a true shell-dweller.

F. MARTIN DUNCAN.

THE HOOP OR TOP SHELL.

HOW TO KNOW THE WILD FLOWERS

By the REV. H. PUREFOY FITZGERALD, F.L.S.
With Photographs by HENRY IRVING

THE FLOWERS OF THE WATER-SIDE—II

YELLOW LOOSESTRIFE

THE Great Yellow Loosestrife (*Lysimachia vulgaris*) is an erect growing plant, between two and three feet high, which is found in moist, shady places. At intervals up the stem, three or four leaves spring, arranged in a whorl, and the yellow flowers grow both from the axils of the upper leaves and at the termination of the stems, forming a leafy panicle. The calyx has five teeth, while the corolla also has five divisions, but, like the Primrose, the petals are not separate; the number of stamens correspond with the number of divisions of the

GREAT YELLOW LOOSESTRIFE.

BOG ASPHODEL.

corolla. These are some of the features which place the plant among the *Primulaceæ* (the Primrose family). The name Loosestrife is a translation of the word *Lysimachia*. Pliny states that the name was given in honour of a certain king *Lysimachus*, and he also adds that if the plant be laid on a yoke of oxen, when they are quarrelling, it will quiet them and stop the strife!

BOG ASPHODEL

The Bog Asphodel (*Narthecium ossifragum*) is a member of the Lily family, and will be readily recognised by its stiff, erect flowering stem, about six or eight inches high, bearing at the end a cluster of bright yellow flowers. There are six divisions of the perianth, all of them looking like petals, six stamens, and a single pistil. The little stems of the stamens, called filaments, are covered with white, woolly hairs; the leaves are short and grow near the base of the plant. This little plant is found abundantly in most boggy places, and flowers during the summer.

WATER MINT

The Water Mint (*Mentha aquatica*) is a plant which possesses a strong scent, by which it may readily be recognised. This plant is generally found growing in shallow water, sending up soft, hairy stems about a foot high, ending in a more or less globular head of lilac flowers; a few other heads also appear from the axils of the upper leaves. If

WATER MINT.

one of the flowers be examined, it will be found to have the same shape as the flower of the Dead Nettle or the Ground Ivy; that is to say, that the portions of the corolla form two lips. All these plants are included in the family of *Labiatæ*. There are five teeth in the calyx, which is also slightly two-lipped; four stamens, all of the same size, will also be found.

The Corn Mint (*Mentha arvenis*) is very similar in appearance, and almost as common, but is found growing in fields. Both species flower during the summer and autumn.

THE ARROW-HEAD.

ARROW-HEAD

The Arrow-head (*Sagittaria sagittifolia*) is a member of the same family as the Water Plantain (*Alismaceæ*), but it differs very much in one respect; inasmuch as the Water Plantain bears both the stamens, and stigmas with seed bearing carpels in the same flower, the Arrow-head bears two distinct kinds of flowers, the upper ones being the males, bearing stamens, and the lower ones the females, possessing the future seed vessels; the latter will be seen to be more shortly stalked than the former.

The leaves are very distinctly shaped in the form of an arrow-head, and rise from the water on long stalks; the three inner portions of the perianth are white with a purple mark at the base, and much longer than the three outer green ones. The flowering time extends through the summer and early autumn.

H. PUREFOY FITZGERALD.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.
Author of "Wee Tim'rous Beasties," etc.

THE SHORT-TAILED MEADOW MOUSE—II

SHORT-TAILED FIELD MOUSE. FIELD VOLE. COMMON VOLE.

With Photographs by the Author

HAVING marked down the particular community of Meadow Mice referred to in my previous article, and not being aware of the existence of any other in the immediate neighbourhood, I endeavoured to trap some of the mice alive. In this I was completely unsuccessful. I tried the ordinary mouse-traps, drop-traps of several standard kinds, small pitfall traps, traps of my own devising, and even springes to entangle their feet. I tried every bait which was known to me, and several new ones by way of experiment. Everything failed.

SHORT-TAILED MEADOW MOUSE.

It is curious that no really effective bait for these mice, or "safe" means of poisoning them wholesale, has yet been discovered. In "Geoponica," a compilation of Greek papers on Agriculture, which dates from about 920 A.D., I find the following: "Apuleius suggests smearing the seed with ox-gall and the mice will not touch it, but it is better to get some hemlock seed in the dog-days, and mince it up with hellebore and meal, or to mince together wild cucumber, or henbane, or bitter almond, and black hellebore, mix it with equal parts of meal, make a paste of it with oil, and put it in their holes. Tasting, they die. In Bithynia practical farmers stop their holes with rhododendron leaves, so that the mice, rushing out of the holes, seize the leaves with their teeth. Seizing, they perish." The writer here breaks off suddenly and proceeds with almost vicious abruptness: "Take paper and write as follows — *I adjure you mice that are found here, do me no harm, nor suffer another mouse to do me harm, for I give you this field* (here insert details of the field). *If I catch any of you here after this, when I get you, by the Mother of the Gods, I will cut each of you into seven parts.*

"When you have written this, glue the paper, before sunrise, to some stone in the field where the mice are, and be sure that the writing faces outwards. I have included this in case it might appear that I had left anything out. I don't accept everything of this kind myself, heaven forbid! And I recommend any one who does not wish to be made a fool of to follow my example."

A millenium has not advanced us much. During the plague in Thessaly in 1892, steps were taken to procure, on the one hand, holy water from Mecca, and, on

the other, some up-to-date virus from Berlin.

Eventually I caught two of the Meadow Mice in my hands. One, quite a young

A TYPICAL MEADOW MOUSE'S SURFACE RUN OPENED WITH THE FINGERS AND VIEWED FROM ABOVE.

The run started from the hedgerow and went twenty yards into the field. Several culs-de-sac can be seen.

one, I secured while he was snaking in the grass farther from home than he should have been. The other I judge to have been the head of the clan. His capture was less orthodox. I had been standing quietly over the stump and suddenly caught sight of his eyes. Something had occurred to prevent his reaching either of the shafts. He had, therefore, flattened himself against the wood about six inches from safety, and was staring backwards over the top of his head, just as a Water Rat does when it hopes you have not seen it, but at the same time wishes to keep an eye on you. He harmonised so neatly with his surroundings that it was mere chance which enabled me to sight him. As I caught him he bit me rather severely, and he continued spiteful until I released him.

The growth of the hay put a stop to my direct observations of these mice, but I had had time to determine several of their characteristic attitudes, which are reproduced in the illustrations in this and the previous article. As soon as the hay was cut I had the curiosity to investigate their runs more closely. None of these could fairly be termed subterranean, though some had been deepened by wear slightly below ground level. In several instances there were small blind sidings from the main track, reminding one of the surface runs of the Mole, and perhaps similarly constructed with a view to wayside refreshment.

I have found that, where a colony of Meadow Mice has fairly established itself, there is a tendency for the runs to be slightly deeper and to present an arched roof *above* ground level, which consists of soil lightly held together by root fibres from the adjoining grass. Such runs can be traced by the simple expedient of running two fingers along them, and their characteristic appearance can be seen in the accompanying illustration.

It would be hardly reasonable to compare such normal conditions as the foregoing with the abnormal conditions prevalent during a Mouse plague, but I think that, slight as my observations have been, they may help us to the conclusion that, given a quick-breeding mouse of this kind, with a simple, indiscriminate taste in vegetable food, a strong inclination to feed under cover, a corresponding disinclination to roam afield, and a modicum of low cunning, it needs little more than an unusually rich combination of food and cover to make him multiply exceedingly, and spread, slowly at first, but with increasing speed as his numbers increase, from exhausted districts to those

A PURE ALBINO SHORT-TAILED MEADOW MOUSE.

Among the millions of this species which have come directly under human observation less than half a dozen examples of albinism, complete or partial, have been recorded. These photographs may therefore be fairly regarded as photographs of one of the rarest animals known.

more favourable. He will only be checked when cover fails him, and it would appear to be Nature's design that he himself should be responsible for the failure of cover. Once he has abandoned the marshland he has broken the law of the wild, and his extermination is dependent solely on the speed with which his furred and feathered enemies can assemble.

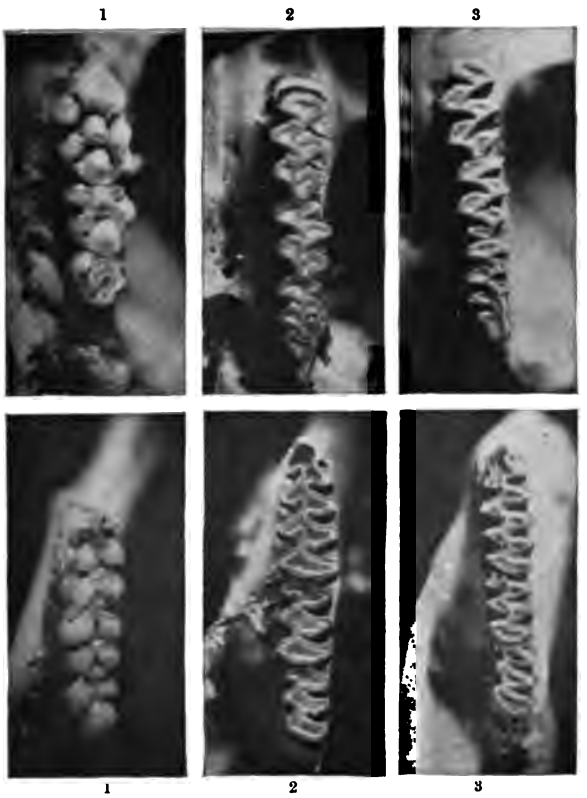


PHOTO-MICROGRAPHS OF THE GRINDING SURFACES OF THE LEFT UPPER AND LOWER MOLAR TEETH OF

(1) The Long-tailed Field Mouse: bunodont type.
(2) The Red-backed Meadow Mouse. Teeth rooted. Prismatic spaces 5, 4, 5; 7, 3, 3.
(3) The Short-tailed Meadow Mouse. Teeth not rooted. Prismatic spaces 5, 5, 6; 7, 5, 3.

The most obvious adaptations of the Meadow Mouse to his marshy surroundings are to be seen in his fur and in his grinding teeth.

In a previous article I referred to the peculiarities of the incisors (front teeth) of Rodents. The entire absence of canines (dog teeth) is characteristic of the order, and between the incisors and the molars (grinding teeth at the back) there is a toothless gap which is termed the diastema. In many instances the furred borders of the lips curl in so as partially to fill this gap, and it has been suggested that this fur insertion may save the animal the discomfort of swallowing material which it intends merely to gnaw.

Some such provision would be almost essential to the true Mice, and to the Red-backed Meadow Mouse, while even the Short-tailed Meadow Mouse may, on occasion, gnaw without the wish to feed; in dressing his own fur, for instance, or in nest-building.

It may be mentioned that in nest-building, Meadow Mice construct the soft lining of their nests by biting grass stems into short lengths of an inch or less. They soften these short lengths by pulling them between their teeth, and, as the grass has a tendency to split apart in this process, they can deal with a large mass of material in a very short time.

If reference be made to the illustrations on this page, it will be seen that the molar teeth of mice (they have three molars on each side of their upper and lower jaws) present peculiar and somewhat intricate patterns. The type of molar found in the true Mice is shown in Fig. 1; that of the Red-backed Meadow Mouse in Fig. 2, and that of the Short-tailed Meadow Mouse in Fig. 3. It will be seen that the first type differs materially from the other two. In this "bunodont" type of dentition (which we ourselves possess) the grinding surface of each tooth consists of several small hillocks of enamel arranged in more or less parallel rows—three rows in this case of the upper teeth, and two of the lower. Such teeth are adapted for masticating fish, flesh, fowl, or good red herring, and, of course, any kind of soft vegetable in addition. In the Meadow Mice the molars are far more highly specialised. Their surfaces present a zigzag series of rough triangles. The sides

of these triangles are formed by ridges of hard enamel, while the " prismatic spaces " enclosed within the sides consist of soft ivory, which, besides maintaining the shape of the tooth, is probably resilient enough to serve as a cushion for the more brittle enamel. The ivory naturally wears hollow, and it is obvious that, when the lower jaw works quickly back and forward, a number of cutting edges are simultaneously brought into play, with the effect of a mincing and grinding machine combined. No better form of tooth could be imagined for dealing quickly with rough marsh-land vegetation.

Considerable importance is attached to the *number* of the prismatic spaces as a means of distinguishing one species of Meadow Mouse from another, and if the spaces always composed themselves into figures which might reasonably be called distinct triangles, or indeed distinct anything, this canon would be practically as well as theoretically useful. The difficulty, however, of defining a " prismatic space " is shown by the fact that, whereas Continental naturalists appear to recognise as many prismatic spaces as possible, English naturalists appear to recognise as few prismatic spaces as possible. In the case of the lower jaw of the Short-tailed Meadow Mouse, for example, French reckoning gives the number of prismatic spaces in the three teeth as 9, 5, 3, whereas English reckoning gives them as 7, 5, 3.

It would be expected that an animal whose normal habitat was damp would be coated with a fur which would tend to throw off water; a fur, that is, which, apart from any natural oiliness, would be mainly composed of fine hairs set closely together, and without pronounced spear-tips.

This is unquestionably the case with the Short-tailed Meadow Mouse and his near relation, the Orkney Meadow Mouse, whereas in the case of the Red-backed Meadow Mouse and the true Mice generally, the tendency for each hair to become spear-tipped is marked. This tendency is accompanied by a redder coloration, owing to the fact that the pigment cells, which, for the greater part of the hair's length, are arranged in a single row, tend, in the spear-tip portion, to break up and diffuse their pigment. Measured under the microscope, the average width of the thickest portions of the hairs of the four species works out as follows :—

Orkney Meadow Mouse	·018 mm.
Short-tailed Meadow Mouse	·026 mm.
Red-backed Meadow Mouse	·052 mm.
Long-tailed Field Mouse	·045 mm.

The result of the fineness of the hair in the first two species, with which is associated a brown rather than a red coloration, is that the individual hairs lie close to one another almost to the tips, and thus form a covering which is impervious to ordinary moisture.

DOUGLAS ENGLISH.

THE ORKNEY MEADOW MOUSE.
Distinguished by its larger and heavier build, shorter relative length of tail, blunter muzzle, and finer hairs.

HOW TO KNOW THE TREES GROWING IN BRITAIN

With Notes, descriptive and photographic, for their Identification in all Seasons of the Year

By HENRY IRVING

THE ALDER AND THE HAZEL

THE Alder is the guardian of the water-meadows. Its matted roots bind the river banks against erosion; its ranked stems march with the stream; its deep green, glistening, and long-lasting foliage provides long succession of cool retreats by shaded pools. Occasionally it may be found standing back somewhat, growing by a single stem into a well-proportioned tree of moderate size; but its general habit is to fling up from the water margin a series of strong stems, outspreading, bush-like. Thus grouped and multiplied, it marks the course of the stream winding through the meadows; or bounds the waters of the mere, shade meeting shade in the reflection of quiet waters. For as there is no tree—not even its contrasting companion the Willow — that loves better the moist places, and the moist atmosphere over these, so no tree looks more at home, or fares better there. It seems to be equally content in the savage glens and ravines of the Highlands, and in our soft lowland meadows.

THE ALDER IN WINTER.

In *winter* its twigs are never wholly bare. Its multitude of little groups of cone-like fruits now gaping open, its even more numerous tightly closed, clustered cylinders—the flower catkins that are to be—give to the leafless tree a partly clothed appearance. And as these young catkins are already richly coloured, reddish brown to crimson, they impart a warm glow to the maze of twigs in the winter sunshine.

In *spring* the old cones are still there. The catkins of the pollen-bearing flowers elongate almost as early as those of the Hazel, and hang pendulous, covering the tree, as with living mantle of bronze, some weeks before there is the least sign of the later greenery.

In *summer* its deep green foliage, gathered into full masses, affords strongest contrast to the light filminess of that of

THE ALDER IN SUMMER.

ALDERS · "SHADE MEETING SHADE IN THE REFLECTION OF QUIET WATERS."

its companion Willows, suggestive of cool shade, somewhat dull and slumberous through days of gloom, but awakening and twinkling in sunshine.

In *autumn* the leaves merely darken still more, getting a touch of sombreness before their fall, which occurs later than with most, for the Alders are still green when other trees are glowing in orange and gold, and some are bare. Already are present, hidden away among the leaves, the young flower catkins in preparation for the following early spring-time.

The *stem*, if divided, raises its separate members direct from the soil of the river bank. The *bark* is dark in colour, furrowed and scaly. The winter *twigs* are brown, triangular in section, as are also the *resting buds*. These are placed spirally on prominent bosses, with supporting stays passing down the twig. They are all but enclosed in a single scale, and for further protection are coated with a light waxy "bloom." They are distinctly stalked, a unique peculiarity of the Alder among our trees; though there is some suggestion of stalks to the buds of the wayfaring tree. Here we get a reminder of the fact that these and all buds are, in reality, the first beginnings of branches, that they were more correctly thought of as cradled twigs than as cradled leaves. That the buds of the Alder are truly stalked may be seen from the position of the leaf-scar, at the base of the stalk. Buds which on many trees terminate dwarf shoots have the appearance of being stalked, notably on the Beech, but in these the scar will be found just under the bud on the top of the stalk, whilst the stalk below will show a series of crowded scars. There are no such

TRUNK AND BARK OF THE ALDER.

scars on the stalk of an Alder bud. The leaf-scars at the base of the bud-stalks of the Alder are heart-shaped (sometimes

YOUNG CATKINS AND OPEN CONES OF ALDER TWIG IN WINTER.

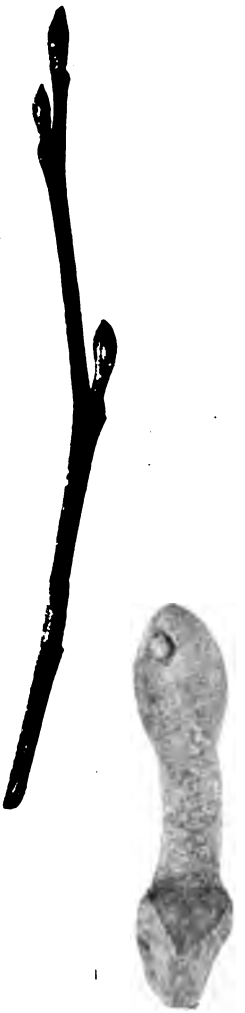
rhomboid), and show from three to five leaf-traces.

The *leaves* are rounded, tending to egg

ALDER LEAVES.

or heart shape, with broad, often deeply notched apex. They are of a deep shining green, and when young are somewhat sticky. The margin is cut into irregular teeth. The midrib passes direct to the apex, with five to seven pairs of side ribs to the margin.

The pollen-bearing and fruit-producing *flowers* are separate, but grow on the same



TWIG AND RESTING BUD (ENLARGED) OF ALDER.

tree. As already stated, they may be found, in their preliminary stages, in the preceding autumn, and are exposed all through the winter. Till February they are stiff cylinders, richly coloured, brown

to crimson. The pollen-bearing flower cylinders then expand, hang down loose and pendulous, a beautiful bronze, casting their pollen on the winds. The smaller stiff cylinders of the fruit-producing flowers grow in stalked groups of three to seven, and already have the appearance of tiny reddish cones. In process of transformation these enlarge on lengthening

THE HAZEL.

stalks, and become still more cone-like, woody and green, the size of beans.

The *fruit* is contained in this woody, cone-like receptacle, the hard scales of which gape open later to set it free. It is then carried by the wind, or floats upon the water, seeking right conditions for growth. But the hard gaping cones will be found on the tree for many months to come.

THE HAZEL

With us the Hazel is seldom allowed to grow into a tree. Found usually in our hedgerows, where it is frequently hacked and clipped, or as under-growth in the coppice, where it is systematically cut down to the stool, it has little chance of attaining size or proportion. Nor, indeed, does it evince any marked desire or aptitude in that direction, but rather the reverse. It prefers to maintain itself on a number of stems, and is continually throwing up fresh ones in the shape of strong stool and root suckers. So it must be regarded as a tree that, for reasons of its own, has chosen to adopt the habit of a bush, and best prospers so. We noted a similar tendency in the Alder, and shall find some other trees adopting more or less a like habit.

In *winter* should be noted the immature pollen-bearing catkins, stiff brown cylinders, slightly curved, in groups of two or more, growing mostly along the sides of the twigs. For the Hazel, like the Alder, makes preparation for the earliest possible flowering; but the Hazel is in the greater hurry. A day or two of warm

sunshine in January, and even in December, will often cause one or more of the stiff cylinders to lengthen out and hang down yellow with pollen as if eagerly anticipant of spring.

When *spring* really comes these yellow catkins are abundant. The Hazel then has all its pennons out in welcome, and they make a goodly show. Now must be looked for the little crimson flame-crests on many of the side buds, tiny but brilliant bits of colour, the only outward manifestation that the fruit-producing flowers choose to make. The leaves do not put in an appearance till considerably later.

In *summer* the broad leaves extend themselves in open layers on the spreading branches; and, if under partial shade as undergrowth in an oak wood, it is interesting to note with what purposed skill each layer of foliage secures the utmost of available light. Now should be watched the gradual uplifting from the twig of the young fruits, rising out of stalkless buds to stalked clusters with attendant leaves.

TWIG AND RESTING BUD (ENLARGED) OF HAZEL.

In *autumn* the foliage changes to yellow and rusty brown; the light green nuts in their frilled mantles assuming their characteristic nut-brown tint.

The *bark* on the stems is smooth. The *winter twigs* are brown and decidedly hairy. The *resting buds* are rounded, somewhat blunt, and flattened on the outer surface. They stand out from the twig on rather prominent bases, are greenish to brown in colour, and show several protecting scales. They are arranged al-

HAZEL LEAVES.

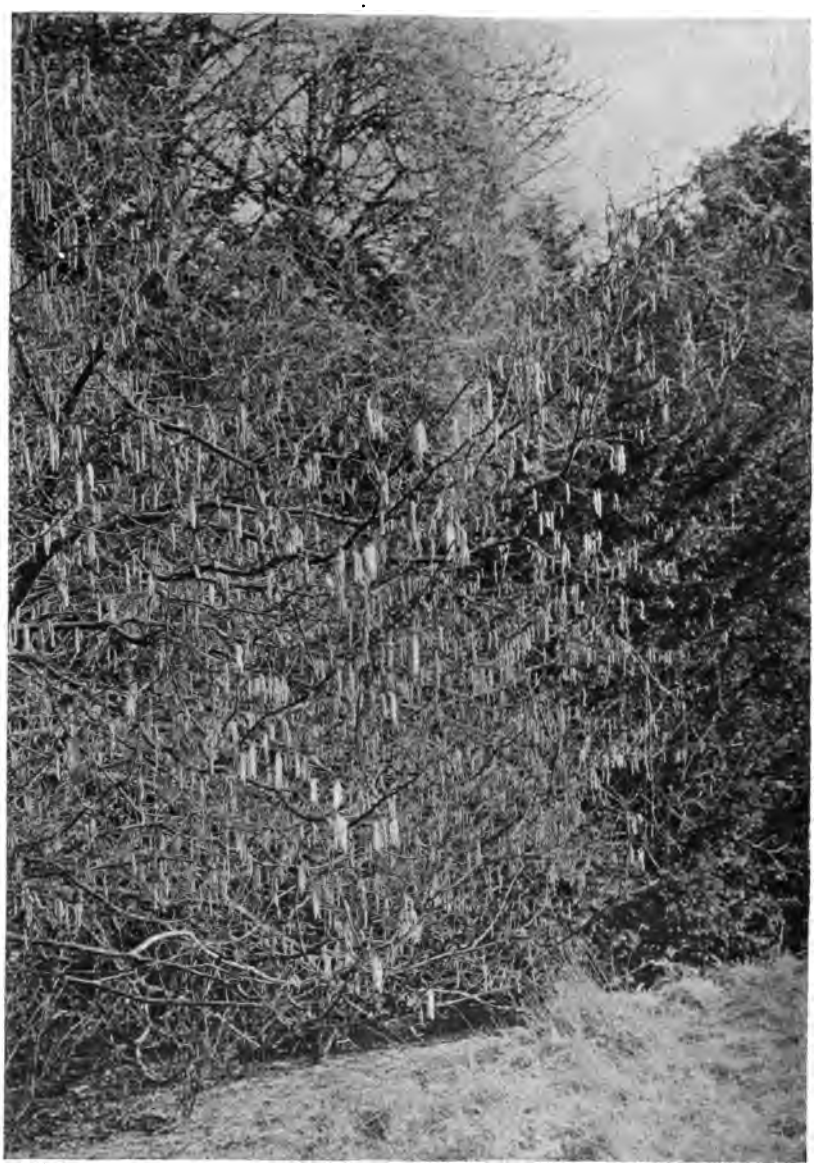
ternately on the twigs, but spirally on the erect suckers. The *leaf-scars* are almost semi-circular, with three leaf-traces.

The *leaves* are softly downy when young, but later become somewhat coarse and hairless. They are rounded, or broadly oval, with a suddenly elongated point at the apex; those on the suckers may show three such points. The margins are broken up into large teeth edged with smaller ones. There is one midrib with pairs of side ribs branching out from it. The short leaf-stalks are covered with glandular hairs that secrete a sticky substance perceptible to the touch. The *flowers*, pollen-bearing and fruit-producing, are separate, but to be found on the same tree. The pollen-bearing flowers, as stated above, are exposed through the winter as stiff, and short, brownish cylinders, growing, as spring approaches, into long pendulous yellow catkins in clusters. The fruit-producing flowers are enclosed in buds, slightly more rounded than the leaf buds, till in the spring they thrust forth their tiny crimson plumes. So they wait, receptive, for the wind-scattered pollen. Some weeks later the leaves unfold; then each flower bud starts into growth, producing eventually a stalk, with leaves, and clustered fruit.

The *fruit* is, of course, the typical nut with its scalloped husk, hard brown shell, and nutritious kernel. These nuts are so assiduously collected and planted by the squirrels, though for quite other purposes, that these lively little creatures may be said to be the main instruments in the dispersal of the seeds.

There is a Hazel gall-mite, similar to that which infests the Birch, which produces rounded swollen buds that never properly open. There is also a nut Weevil, a small brown beetle with a long snout, which inserts its egg into the young nut, and this develops into the fat maggot so often found in place of the sweet kernel.

HENRY IRVING.



THE HAZEL'S WELCOME TO THE SPRING.

HOW TO KNOW THE INSECTS

By JOHN J. WARD

Author of "Some Nature Biographies," "Peeps into Nature's Ways," etc.
Illustrated from Original Photographs by the Author

PROTECTIVE MIMICRY

WITH the increasing host of insects, there is always a corresponding increase amongst their enemies. On this account, insects that appear late in the season run greater risks than those which make their advent earlier, for there are many young mouths to fill as the season advances. Insectivorous birds and other animals are ever on the alert for anything that moves amidst the grass, leaves, or branches, but the insects themselves show no such activity in eluding their foes. Many of the largest and most handsome species make not the least attempt to escape should the enemy approach. It is well, indeed, that they do not, for any active endeavour to escape would mean their sure destruction. Strange as it may seem, their chance of life often entirely depends upon their remaining quite still and thus presenting a negatively bold front to the enemy.

I propose, in this paper, to deal with a few of the numerous examples which illustrate how insects hide to protect themselves from their enemies. Those

TWO GREEN-VEINED WHITE BUTTERFLIES ON THE FAMILIAR GREEN AND WHITE STRIPED RIBBON GRASS.

who would learn to know the insects are just as likely to be "tricked" by the extraordinary guises they assume as a means of protection as are their natural foes. It follows, therefore, that this subject comes well within the scope of these papers.

The three common White Butterflies, with which everybody is more or less familiar, are known respectively as the Large White (*Pieris Brassicæ*), the Small White (*P. Rapæ*) and the Green-veined White (*P. Napi*). The first is readily distinguished by its size; the two latter are frequently confused, as they are both extremely abundant, and very similar in colour. The Green-veined White, however, may be distinguished by observing the under side of its hind-wings, which are conspicuously veined with green, from which feature the insect derives its popular name. It is well known that during sunlight these insects are always on the alert, and also that they are very capable insects when on the wing. It is obvious, therefore, that during sunlight they need little or no protection except their power of flight; but at night and on dull days, when they rest, these White Butterflies are conspicuous objects and necessarily have to hide away beneath leaves and in similar situations.

POPLAR HAWK-MOTH RESTING ON THE BARK OF A POPLAR TREE.

Now, during the summer of 1907, Green-veined White Butterflies were very abundant in my flower garden (this year I have seen but few), and I then discovered one method by which these insects secured protection during the nights and the whole of dull and wet days. Indeed, during the month of May, I could almost invariably find in the garden at such times a fair number of these butterflies. It so happened that some clumps of the familiar Ribbon or Lady's Grass had been allowed to grow large, and while pulling out some of this I found that I frequently disturbed a Green-veined White Butterfly. For a moment this surprised me, and then I suddenly realised the meaning of it. I immediately went to another clump of the grass at another part of the garden and disturbed it, and at once butterflies appeared. Another clump yielded a similar result; indeed, each of the whole six clumps provided from one to four butterflies.

Why were the butterflies amidst the grass? To answer that question I will ask my reader to glance at the first illustration. There are shown some blades of the familiar green and white striped grass. Observe, too, that amongst them there are two Green-veined White Butterflies. In the photograph on p. 211 the butterflies are conspicuous enough, because I have removed some of the blades from before the insects so as to show them in the picture. But let me now ask my reader to think of the conditions as they were in reality. The blades of grass striped and shaded irregularly with green and white, the butterflies hidden in amongst the crowded blades with their white wings pressed closely together, exposing only the under sides of the lower wings—the green-veined wings. The harmony was perfect; you might look *from above* a hundred times and yet never see a butterfly; to accomplish this you had to assist your eyes with your hands.

It was no coincidence. Evening after evening I could find butterflies amongst the grass. Even during the bright sunlight I frequently saw some of them alight amongst the grass blades to rest, just as if they knew that the situation offered them protection.

This instance of protective mimicry in connection with this common insect and a familiar garden plant has not, I think, been previously observed, and I offer it to the readers of "The Nature Book" as a novel instance which they may investigate on their own account. It should be remembered, though, that it must be the Green-veined White and not the Small White Butterfly that should be found amongst the ribbon grass. The latter, although it resembles the former, is a distinct species, and its hereditary instincts would be altogether different; for we have to recognise that the butterflies do not think out these protective schemes, but that they are the outcome of an instinct, inherited from habits of their ancestors, which have served a useful purpose in the development of the race.

It is probable that every insect possesses some similar hereditary protective devices. Some of these devices are, when observed, very obvious, as in the case of the caterpillars of the Swallow-tail Moth, with which I dealt in my first paper. In other cases the significance of the protective mimicry may completely evade us, though it be plainly before the eye. Some of the most handsome Hawk-Moths while resting openly exhibit mysterious arrangements of colour about their wings which, although conspicuous enough, yet seem to deceive the eye in such a manner that the insect escapes recognition as such. I referred to this feature when dealing with the Lime Hawk-Moth, and now we may glance at another curious instance in the case of another common Hawk-Moth. In the second illustration is shown the

PRIVET HAWK-MOTH RESTING WITH WINGS PARTIALLY EXPANDED.

Poplar Hawk-Moth (*Smerinthus populi*) resting on the bark of a poplar tree, as it might be found at any time towards

FEMALE BLACK ARCHES MOTH.

the end of May until early July, and occasionally in the autumn, from a second brood.

The moth has beautifully marbled wings of a soft buff-grey colour, and the lower wings are similarly coloured but of a bright orange shade of brown at the base. This coloured part, however, is covered while the moth is resting, as it appears in the photograph on page 212, and the peculiar manner in which the hind pair of wings appear first, give the moth a curious resemblance to a fallen leaf which is discoloured and shrivelled and adhering to the bark. Of course, it only needs a glance to see that it is not a leaf, but the whole arrangement is unobtrusive to the eye, and the untrained observer, even while searching for insects, would probably, if his gaze fell on such a moth, be deceived, and would turn away towards what seems like more profitable searching-ground. Therein probably lies the moth's main protection. If it attempted to hide in the fork of a branch or amongst the leaves, a large moth of that description would soon be discovered by the diligent insectivorous searchers that are persistently at work amongst the branches; but this bold front, combined with the subtle colour and superficial resemblance to a wind-blown leaf adhering to the bark, completely deceives the enemy. If a hungry bird espies it, it does not stop to investigate. Food requires searching for, and it would be too absurd to suppose that it would be exposed in that prominent way; so, like the untrained observer, the bird seeks more profitable fields. Almost invariably these moths will be found resting in such exposed situations. Not infrequently they will be seen on posts and palings, sometimes on flat wooden fences; which again illustrates the fact that the moth is only carrying out its hereditary instinct, for on a flat fence it is a most conspicuous object.

What I have written regarding the Poplar Hawk-Moth also applies to the insect illustrated in the next illustration (p. 213), where the Privet Hawk-Moth (*Sphinx ligustri*) is shown. In the photograph the moth is seen while taking a temporary rest, with its wings slightly expanded, and in that position it reveals the rosy pink bands that partly encircle its body. When it completely closes its wings, however, its body is covered, the upper pair, which

BUFF-TIP MOTH WITH WINGS FULLY EXTENDED.

are brown and black-streaked, being outside, and so it rests on the bark of trees, posts, etc. About the middle of July the moth may frequently be found in such situations. It follows, therefore,

that those who search for insects should carefully observe tree-trunks, for not only will they often provide specimens of these most handsome Hawk-Moths, but also many other striking specimens that seek protection during daylight by similar methods.

While so searching amongst oak trees a very conspicuous black and white moth may sometimes be found towards the end of July and during early August. This moth is the Black Arches Moth (*Psilura monacha*) whose caterpillar I illustrated in my last paper. In the illustration on page 214 the female moth is shown. This moth certainly looks conspicuous on the dark-coloured bark of the oak tree where it is not infrequently found, for the caterpillar often constructs its cocoon amongst the crevices of the bark, and necessarily when the moth emerges it first appears upon the bark and there unfolds its wings, often so resting for several hours after its emergence. The male moth may be readily recognised by its smaller size and feathery antennæ. Although the moth appears to us so conspicuous on the bark, yet probably to its natural enemies it is much less so: for such irregular splashes of black and white colour are frequently seen about the bark where birds have been moving. On the other hand, it may be quite conspicuous to insectivorous foes, and its black and white wings may be its "warning colours" indicating to them that it is inedible and unwholesome for food, as I suggested in the case of the variegated livery of the caterpillar.

A PAIR OF BUFF-TIP MOTHS RESTING: SHOWING THEIR RESEMBLANCE TO PIECES OF BROKEN STICK.

A paper on this subject would scarcely be complete without a reference to the Buff-tip Moth (*Phalera bucephala*), which is abundant during June and July. This insect is shown with expanded wings in the lower photograph on page 214. Its upper

pair of wings are of a silvery-grey colour, with an oval buff patch at the tip. When the moth comes to rest it wraps its fore-

COCKCHAFER BEETLE FEEDING.
The lower photograph was taken three minutes after the upper, and shows the progress made by the Beetle in his meal.

wings round its body in a peculiar manner, which gives it the appearance of a bit of broken stick, its buff-coloured head, and the patch of the same colour on the tip of each fore-wing, resembling the broken ends of the stick. The illustration on page 215 will explain the matter better than a volume of words. There a pair of the moths are shown just as I found them resting. These interesting moths are very common, and may be found about the bark of various trees, especially elms, and not infrequently amidst the grass and herbage.

Another insect that resembles a bit of broken wood or peeled-off and shrivelled bark is the familiar Cockchafer Beetle (*Melolontha vulgaris*). At night time it takes to its wings and is a bold but somewhat reckless flyer. One night, while cycling, my bell suddenly rang out one note quite loudly. No one was near, and I had not touched it. A little startling, it is true; but I knew that the invisible musician was no other than the clumsy Cockchafer; a second later I heard his horny body fall amongst the herbage in the ditch. What he thought of the noise, to say nothing of the shock, will always remain unknown. During the day these insects sleep amongst the leaves, but occasionally they wake up and munch a piece of the leaf, as shown in the illustration on this page.

I now only have space to add the illustration, referred to in my last paper, of the Brimstone Butterfly. The photograph shows the newly emerged butterfly clinging to its empty chrysalis skin, while its wings dry and come under muscular control. The butterfly that emerges in July or August lives throughout the winter, but where it hides during that period is a complete mystery. Holly bushes have been suggested as a likely place, and it has been pointed out that its quaint-cut wings resemble a yellow, dried holly leaf. The suggestion is ingenious, but I have never yet discovered a Brimstone Butterfly in that situation, although I have searched many times; neither have I heard of any one who has so discovered

A BRIMSTONE BUTTERFLY JUST EMERGED FROM ITS CHRYSALIS, TO WHICH IT IS CLINGING WHILE ITS WINGS DRY.

it. Nevertheless, on the first sunny day that presages spring, the butterflies appear—from somewhere!

JOHN J. WARD.

A CORNISH SEA AT HALF TIDE.
From the painting by Arthur J. Black.

WAVES BREAKING ON A REEF.

WAVES AND THEIR WORK

By F. MARTIN DUNCAN, F.R.P.S.

With Photographs by the Author

A WINTER storm on a rock-bound coast is an awe-inspiring sight, which once seen is not easily forgotten. What a change from the brilliant sunlight and gently flowing tide of the summer, to the hurrying grey storm-clouds, the boom and crash of the waves thundering against the cliffs, and the wild screech of the beach as the pebbles are drawn down by the backwash! Then it is that we begin to realise the devastating power of the waves, and the work they accomplish.

The waves are constantly at work along the whole eastern coast of England, eating away the land, so that from Flamborough Head to Kilnsea, where the strata are composed of drift or boulder-clay—comparatively unresisting materials—from two to four yards of land disappear annually; and in the same way all the soft coast cliffs from the Humber to the mouth of the Thames are being washed away by the waves. Historic Ravenspur, where Bolingbroke landed in 1399, has long since disappeared beneath the surface of the sea, and the old town sites of Dunchurch and Cromer lie beneath the waves of the North Sea. Amongst the fisherfolk of Norfolk an ancient superstition still lingers, that on dark and silent nights before a tempest, the old bells of the long since buried church of ancient Cromer may be heard faintly ringing a warning peal.

The coasts of Kent and Sussex are also in many parts being rapidly worn away. The twin towers of the ancient church of Reculvers would have disappeared beneath the waves long ago but for the stout sea-wall and groins which have been built to protect them; while the site of old Chichester has quite disappeared, swallowed up by the all-devouring waves.

A ROCK TOWER ISOLATED BY THE WAVES: "OLD HARRY," SWANAGE.

The sea takes advantage of every weak point in the strata of the cliffs, so that every seam of soft earth or rock formation is attacked and eaten away by the waves, leaving the harder and more resisting rocks standing; and it is in this way that the bays, capes, and promontories have been formed. Looking at a geological map of Great Britain, we can trace the hard "basset," the upturned edge of the chalk formation, running diagonally from Dorset to Yorkshire; on the southern shore forming the promontory and cliffs of St. Alban's Head, and on the Yorkshire coast the magnificent headland and cliffs of Flamborough. Following its inlying edge that surrounds the Weald, we trace the "basset" to the shore at Dover where the gigantic mass of Shakespeare's Cliff towers aloft, and again where it touches the Channel, we see Beachy Head rising majestically from the waves. But for the durability of this harder chalk formation, the Isle of Wight would prob-

WAVES UNDERMINING A CLIFF.

"BUT FOR ITS IRON-BOUND COAST . . . . CORNWALL MUST LONG SINCE HAVE DISAPPEARED BENEATH THE ATLANTIC."

ably have long since disappeared. It forms, however, the rocky backbone of the island, and every visitor to that delightful spot knows the beautiful towering chalk cliffs of Freshwater, that beat back the hungry waves, and the Needles rocks, that once formed part of the island.

If we travel down to the Land's End during the winter months and witness some of the terrible storms that sweep

A GATHERING STORM ON THE DORSET COAST.

along its cliffs, we soon realise that but for its iron-bound coast of hard granite and metamorphic rocks, against which the angry waves hurl themselves in vain, Cornwall must long since have disappeared beneath the Atlantic.

Where the set of the current is strong, the *débris* torn from the cliffs and pounded by the waves into fine sand and shingle is carried away, the finer particles out to sea, where they accumulate and form treacherous, shifting sandbanks, like the Goodwins; while the coarser pebbles form the ever-moving pebble beaches, of which the Chesil Bank near Portland is a familiar and remarkable example. The waves are hard at work striving to sweep away Portland, which forms a natural groin protecting the Dorset coast, and once the work of destruction is completed, the coast of Dorset will have to face the full fury of the storm-lashed waves.

Although the work of wearing away the cliffs is constantly going on, there is a certain amount of give-and-take, for in situations along the coast where the currents do not run so fast, or where they set more towards the shore, sand and *débris* is constantly accumulating, so that fresh land is forming. This is seen on flat, sandy shores that are bounded landwards by the low sand-hills or "dunes." These "dunes" are formed when the tide is out and the wind is blowing off the sea. The wind then lifts the sand as it dries, and carries it landwards until it reaches the low scrub of reeds and grasses which grows just beyond the reach of the waves. Here the advance of the sand is arrested, and it falls amongst the stems of the reeds and grasses.

Gradually the sand accumulates and covers the binding mass of vegetation, until a long, low ridge of dunes is formed.

In situations where the waves break upon the shore obliquely, we may watch them at their work grinding down into pebbles the hard fragments of rocks which they have torn from the cliffs. Every incoming wave drives forward obliquely the shingle composed of more or less smooth, rounded rocks of all sorts of sizes; and these, as the wave retreats, seem to give chase, rolling down perpendicularly to the shore line, after it. Rows of wooden piles, or groins, are fre-

quently driven into the beach to arrest the eroding action of the waves, but although this stops the advance of the pebbles for a time, the waves before long pile up the pebbles to the height of the groin, and then start to work to form a new beach a little further from the land. The oblique action of the waves, and how they therefore pile the pebbles always against one side of a groin, is very strikingly illustrated at Brighton on the Sussex coast, between the Palace Pier and Black Rock; where, looking seawards, the pebbles are piled up nearly flush with the top of the right-hand side of each groin, there being quite a drop of three or more feet to the beach from the top of the groin on the left-hand side.

THE BACKWASH OF THE WAVES CARRYING AWAY THE SOFTER SAND AND DÉBRIS FROM THE CLIFFS.

Another wonderful and most interesting piece of work done by the waves is the formation of what are called coast platforms, or sea-terraces. Wherever the coast is being eroded with more than ordinary rapidity, these wave-worn terraces may be seen in course of formation; indeed, in favourable situations several of these platforms are visible at the lowest spring tides, rising as a series of broad shelves or terraces cut out by

TERRACE FORMATIONS AT BARTON CLIFFS.
The three lower terraces are due to the action of the waves at highest and lowest tides, the upper ones to subsidence of the land.

the waves; that nearest the water's edge the waves have formed during the lowest neap tides, the next during the intermediate tides, and the highest reaching to the base of the cliffs during the spring tides. These terraces are formed by the waves in the first place beating against and eating into the cliffs and undermining them; then the unsupported overhanging portions break away and fall into the sea, only to be pounded into fragments and carried off by the currents into deeper water; and in this way the seaward edge of the land is ground and worn down to a more or less uniform level. In many parts of England and Scotland, traces of ancient sea-terraces are to be seen inland and high above the present level of the sea, showing that during geological ages the land has gradually risen and preserved the record of the waves and their work in the past.

F. MARTIN DUNCAN.

THE WRECKAGE OF THE WAVES.

HOW TO KNOW THE TREES GROWING IN BRITAIN

With Notes, descriptive and photographic, for their Identification in all Seasons of the Year

By HENRY IRVING

THE PLANE

ABUNDANT as the Plane tree now is with us, it is of comparatively recent introduction. It has never lost its foreign, almost Oriental, air. We can scarcely be too grateful for the bounteous brightening greenery it uplifts in the ways and squares of our cities, where it holds its own in spite of vitiated air and clogging impurities. It lives, and fairly thrives, and little abates its sunshiny suggestiveness, its Orient fulness, splashing here and there golden gleams over drab streets; in stifling August heat casting cooler shade that by contrast is refreshing. Yet the tree is un-English, with its speckled trunk and limbs, its broad geometrical leaves, its curious dangling flowers and fruits, its billowy massed crown. It is with us pre-eminently the city tree—city and suburban—and by it city and suburb are so far redeemed; but it seems rather out of place in our country-side, and strikes an alien note in our English landscape.

In *winter* the appearance of the tree is distinct and characteristic. Its central stem rises often to the summit, but from it are thrust out large elbowed branches of varied lengths, which follow no very defined plan, so that the tree's form is decidedly lacking in symmetry. The

THE PLANE IN WINTER TIME.

speckled appearance of the trunk and limbs is then most noticeable, as it is at this season that the bark flakes off, leaving light yellow patches on the darker ground, a kind of reversed leopard's spotting. All through the winter its globular clusters of fruit, grouped on

TRUNK AND SCALING BARK OF THE PLANE.

pliant stalks, dangle in crowds among the twigs.

In *spring* the buds are rather late in opening, but when the foliage does appear it is soon full and golden. At the same time the globular groups of flowers on slender hanging stalks, similar in appearance and habit to the still dangling fruits of the previous season, grow out from among the expanding leaves.

In *summer* the rounded masses of broad-spreading, semi-opaque leaves suggest and afford ample and welcome shade. The ripened fruits of the former season have now mostly vanished, and the pollen-bearing flowers also, but the new fruit-globes on their slender stalks are growing apace, so the succession of these may be maintained through autumn and winter to the new growths of another spring-time.

In *autumn* the leaves change to yellow

THE PLANE LEAF.

and orange, or reddish brown. They fall late, exposing fully the dangling fruit clusters.

The *trunk* is round, smooth, and well

THE LEAF AND THE BUD OF THE PLANE.
Showing how the base of the leaf-stalk forms a protective sheath for the bud.

sustained. In age it often becomes roughened and heavily warted at the base. The

WINTER TWIG AND BUD (ENLARGED) OF THE PLANE.

bark is thin and unwrinkled, naturally somewhat greyish, but darkened, if not blackened, by the city's smoke. Here it is that the distinguishing habit of the Plane is so marked and beneficial. The thin bark scales off in patches, exposing the new yellow under-bark, so ridding the tree of the accumulated impurities of city life.

The *winter twig* is rounded, slightly zigzag, and olive green in colour. The *buds* are arranged alternately on the twig; they project, are conical in shape, and are protected by a single brown scale which forms a complete sheath. These buds through all the period of their growth are hidden in the bases of the leaf-stalks, and are exposed to view only by the fall of the leaves. In consequence the *scar* left by the fallen leaf is circular, all but surrounding the base of the bud. It has a sinuous outline, and shows five groups of leaf-traces.

The *leaves* vary considerably, even upon the same tree. They are large, wide-spreading, and markedly geometrical. They have deeply cut margins forming generally five main divisions, each again cut into by smaller indentations. Instead of a single midrib, as with every tree previously considered, the Plane leaf has three main ribs, radiating from the point where the stalk enters the leaf, and terminating in the apices of the three central main divisions. The two remaining main divisions of the leaf are supported by strong ribs branching outwards from near the base of the two outermost main ribs. So the leaf is only approximately of the five-fingered type. Golden when they first appear, these leaves soon acquire their permanent tint of vivid green. Their firm, smooth texture ensures that every passing shower shall wash away impurities, so they are able to breathe and thrive, and continue clean and bright, in positions where most other leafage is soot-soiled and choked.

The *flowers*, pollen-bearing and fruit-producing, are found on the same tree. These appear with the leaves, growing from the tips of new dwarf shoots, both kinds as globular clusters attached to

FRUIT AND FLOWERS OF THE PLANE.

long slender stalks. The pollen-bearing clusters are greenish, changing to yellow as the pollen matures. The fruit-pro-

ducing clusters are readily distinguished by their numerous purple-tipped spines, to which the wind carries the needed pollen.

The *fruits* grow into hard, roughened balls, composed of a multitude of wedge-shaped little nuts. From the thick rounded head of each little nut projects a short, stiff spine, curved at the point. From one to four of these balls, or "buttons," as Americans name them, grow attached to a single, long, flexible stalk. As already stated, these remain on the tree till spring is well advanced. Then the small nuts begin to separate. Each, as it emerges from the cluster, displays a circle of golden hairs arranged and expanded parachute-wise on the inner tip of the wedge-shaped nut. The expansion of these hairs thrusts the nut out from the cluster, and the parachute arrangement sends them sailing down the wind and ensures a wider scattering. The stalks, too, that sustain these fruiting balls from autumn to spring, gradually disintegrate, weather-worn, and become merely ragged fibres that barely support the weight of the ripened nut clusters; so that where these have not already been separately dispersed, they fall in mass about the time that the leaves and flowers have reached maturity.

Two main varieties of Planes are distinguished—the Eastern and the Western. The Western Plane is the "Buttonwood" tree of the Americans. The differences between these varieties are but slight. Most of our Planes are of the Eastern variety; the Western is seldom met with in Britain. Perhaps the commonest of all with us is that specified as "maple-leaved," and very generally as "the London Plane." It approximates to the Western type, though it is usually regarded as a hybrid between the Eastern and the Western. Its chief tendency is to have fewer and less decided leaf divisions than the Eastern Plane, and one, or at the most two, spherical fruit clusters attached to a single stalk.

In distinguishing the Planes from the Sycamore and other Maples, it is enough to note the speckled bark and the alternate bud (and consequently leaf) arrangement of the Plane; also, particularly, the hiding of the bud in the base of the leaf-stalk, or, when the leaf has fallen and the bud is exposed to view, the circular leaf-scar that surrounds it. The Plane's globular clusters of flowers and fruits on hanging stalks also are conclusive as to its identity.

HENRY IRVING.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.

Author of "Wee Tim'rous Beasties," etc.

THE HEDGEHOG

With Photographs by the Author

IN the three following articles I propose to deal with our five insectivorous animals—the Hedgehog, the Mole, and the three species of Shrew Mice.

The order to which these animals belong is an extremely interesting one, not only on account of its antiquity (something very like our Hedgehog has been in continuous existence since the Pleistocene period), but also on account of some peculiarities of structure, habit, and character, which are excellently displayed by its British representatives.

However correct the attribute "insectivorous" may have been in Pleistocene times (and it seems not unlikely that the first small animals on our planet perforce were insectarians), it is characteristic of the modern representatives of the order, found in this country, that their taste in

AN OLD HEDGEHOG.

food is catholic, the only distinct preference they display being for something "crunchable."

There can be little doubt, however, that the tendency to hibernation, which is undoubtedly marked in the Hedgehog and Shrew Mice, and which is probable in the Mole, points to an early stage at which hibernation was a provision of Nature to prevent these small beasties dying of starvation in the winter.

There are certain outward features which are characteristic of all five of our British Insectivora. They are all small animals (it may be mentioned that the largest insectivorous animal known, the Tenrec, is less than two feet long, but atones for this comparative insignificance by usually producing about twenty young at a birth); they are all, under normal conditions, silent animals; they all have long pig-like snouts, and they all have five toes (the primitive number) on each of their four feet. They are plantigrade, and their bodies are slung low between their legs, which results, in the Shrew Mice, in a squirming method of progression, and, in the Hedgehog, in an ungainly waddle, during which his body zigzags head to tail, and he seems at every other step to leave one leg behind him. Neither Hedgehogs nor Moles seem able to sit back on their haunches, but Shrew Mice not infrequently rely on their hind feet alone, and can sit, and even run a few steps, with their fore-feet unsupported.

The outward appearance of the Hedgehog is probably familiar to most people. His back and sides are thickly studded with dark-banded, sharp-pointed, highly elastic quills. These number about 270 to the square inch, and the sum-total of them, taking an average specimen and regarding him as a sphere, works out at about 16,000. Each quill is spindle-shaped with a decided bend at the insertion of the root, and consists of a pith, an inner, and an outer shell. The outer shell is furrowed throughout its length, while a cross section shows that the inner shell (a thickening of which gives hardness to the tip) projects into the body of the quill in a series of ridges which correspond to the furrows without. The pith is traversed by a delicate net-

HEDGEHOG CLIMBING.

work of tissues, which are attached to the projecting inner ridges and to the spaces between them.

The object of this beautiful structure (as a whole) is evidently a nice adjustment between the rigidity necessary if the quills are to act as a defensive weapon, and the elasticity necessary to prevent their breaking short off, or being driven backward through the skin, as a result of a fall or violent blow. I have never known a Hedgehog follow the books so far as to take a fall voluntarily, but a Hedgehog, higher than he cares to be, will waddle backwards and forwards along the edge of the drop, until his own clumsiness eventually sends him over. As he loses balance he instinctively rolls up, and, if the fall is from a fair height, he has time to make a ball of himself. If the fall is a short one he lands anyhow.

THE HEDGEHOG, UNCOILED AND COILED.

An additional protection against the quill acting as a two-edged weapon is afforded by the form of its root. This is mushroom-shaped, the flat surface being towards the skin and the round surface towards the body. The flat surface effectually prevents the quill from being pulled out (a Hedgehog can easily be lifted by a single quill), while the round surface helps to prevent laceration of the tissues below if a sudden blow drives it in. The taper at the root end tends to make the quill more elastic.

The quills are brought to the charge mainly by a sheet of striped surface muscle, the *panniculus carnosus*, which extends over the whole of the animal's body and makes him, quite apart from his prickles, a very difficult subject to skin.

Fragmentary patches of this muscle appear under different names in ourselves, and boys are occasionally to be met

with who have sufficient control of such patches to wriggle their ears and move their scalps. I fancy that these muscles atrophy from disuse, as the power appears to lessen with advancing years.

something like the carapace of a tortoise, with a decided thickening round its lower edges. Beneath this skin-covering, which, under such conditions, would seem to be hardly attached to the body at all,

1. Magnified section of pointed end of quill, showing at the top the pith, the inner, and outer shells; and generally the net-work of tissue in the interior.
2 and 2a. Magnified sections (superficial) of quill, showing the mushroom shape of the root end, and, in 2a, a portion of the erecting muscle attached to it.
3. Magnified superficial view, showing the exterior ribbing.
4. Cross sections, showing the projections of the inner shell into the pith.

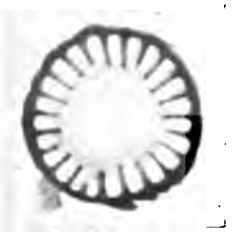
THE HEDGEHOG'S QUILLS.

Though the action by which the Hedgehog converts himself into a ball of spikes can be accomplished in a moment, the muscles which determine it are highly complicated—indeed, there can be few muscles in his body which are not brought into use when he rolls up. If a Hedgehog were to be, in imagination, divested of his quills while in an ordinary standing position, there would appear on the upper portion of his body and on his sides a wrinkled grey skin-covering, in shape lies the sheet of *panniculus carnosus*, and there are connected to it, in addition, a number of powerful muscles, which are linked up to the head, tail, and limbs.

On suspicion of danger, the first thing a Hedgehog does is to wrinkle up his forehead so that his quills project outwards and partially conceal his eyes. Perhaps his most engaging expression occurs under these conditions, for, as can be seen from the illustrations, his eyes acquire an undue prominence when his hair and quills

are neatly brushed back. He next rounds his back and tucks his face, four feet, and tail, together into his stomach. At this stage, viewed from the side, he is shaped like a nautilus, while the last glimpse of his black nose and paws, with their surround of hair, reminds one curiously of a befrilled infant. Finally he tightens up until he is practically spherical, with nothing but quills visible, and every quill pointing outwards.

He now presents a defence which few animals care to engage, though it is said that the fox and badger can pull him to pieces (the badger certainly could), and I have known a case of a retriever who habitually ate Hedgehogs, spines and all, and who eventually died of gastric trouble induced by the consumption of a particularly large specimen. The injury was probably mechanical, as it is not likely that ordinary Hedgehogs' quills would defy a dog's digestion. They can be considerably softened by boiling water, while a few hours' soaking in turpentine will reduce them to a pulpy condition. Each quill, in fact, is a single modified hair, so that, as a general rule, we can find four different kinds of hair in the Hedgehog—the quill, the bristle, the coarse hair, and the fine hair, whose diameters at their thickest portion average 1·2, ·11, ·06, and ·02 millimetres respectively. The bristles and the coarse hairs are remarkable for the small size of their pith in comparison with their shell, while in the fine hairs the pith can hardly be traced at all. A tame Hedgehog enjoys being stroked, and will lay his quills back for that purpose.



HIGHLY MAGNIFIED CROSS SECTION OF THE HEDGEHOG'S QUILL.

I do not think that the Hedgehog deliberately uses his quills for any purpose other than defence. The quaint appearance which he sometimes presents in the spring, owing to the quantity of nest material sticking to him, is due simply to the movements which he has made in settling down in his nest for the winter, and in waking up from his long sleep. The idea that he can climb trees and spike the apples need only be mentioned to be dismissed.

Yet, considering his natural disadvantages of build, he is no mean climber, and I have known one escape from a first-floor room by climbing from the floor to a chair, from the chair to a table, from the table to a window-sill, and thence to the branch of a tree which came close up to the wall. He negotiated part of this branch successfully, then lost his balance and fell, but waddled off triumphant.

The phenomenon of hibernation which I touched on in the case of the Dormouse is displayed even more markedly in the Hedgehog. His torpor lasts from November to March, and is, I think, normally unbroken. I have had the opportunity of making daily observations on the hibernation of three individuals, and I am certain that in these cases the animals remained torpid from the time they turned in until the time they turned out. There are, however, many instances recorded of Hedgehogs roaming at large during hard weather, and I have more than once myself encountered them in snow.

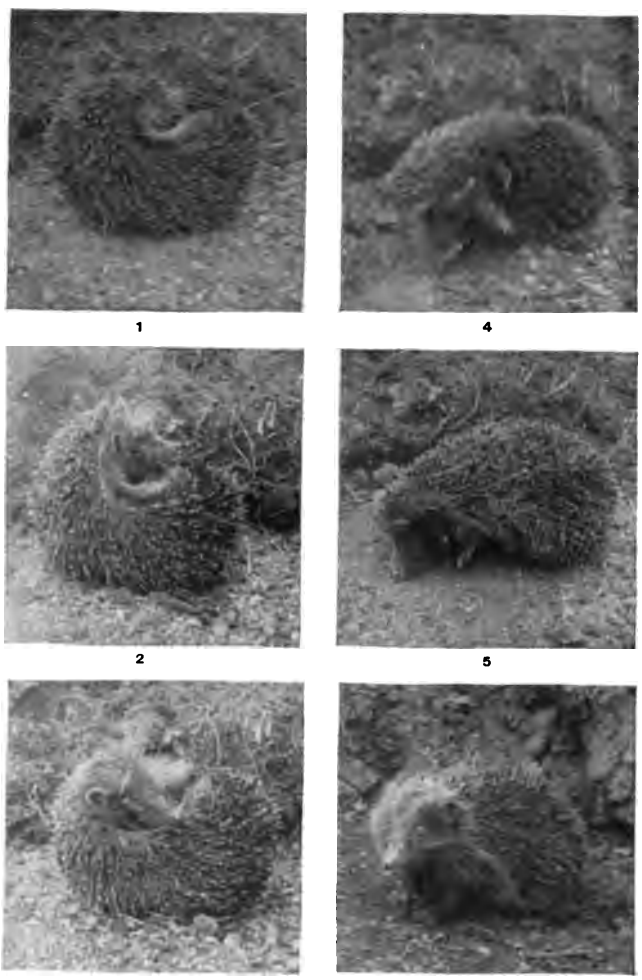
The Hedgehog possesses "hibernating" glands. The nature and function of these are uncertain, but it seems generally agreed that they attain their greatest development in the autumn, and atrophy in the summer. We shall have something similar to consider in the case of the Shrew Mice. So far as the Hedgehog is concerned, the matter has been ably dealt with by Dr. Carlier.* Among the interesting facts he brings to light, is the absence of sweat glands and sebaceous glands (the former, of course, implying an opening to the air) on the quill surface of the Hedgehog's body, and the migration of armies of phagocytes at the commencement of hibernation towards those portions of the animal's body, mostly situated in the alimentary canal, which are, at this critical period, dangerously exposed to assaults of bacteria.

If we consider the normal position of the hibernating Hedgehog—a tightened

* "Contributions to the Histology of the Hedgehog." Edinburgh, 1892.

ball with the conjunction of head and tail towards the ground—the interest of these facts is materially heightened.

Remembering the character of the Hedgehog's natural food, which consists of worms, grubs, snails, beetles, lizards, meadow mice, and generally such small creatures as he can catch by snouting at sundown; remembering also that his hibernation is, as a rule, unbroken, it is not surprising to find that he makes no provision against the winter. Unfortunately for himself the Hedgehog is unable to discriminate between what is (humanly) lawful food and what is unlawful. Where an animal is suspected of damaging either the eggs or young of game, it is difficult to get a fair hearing for evidence in his favour, but the conclusion that, because a Hedgehog may be caught in a gin baited with a broken pheasant's egg and set in his usual run, a Hedgehog must of necessity be a stealer of pheasants' eggs, is, on the face of it, absurd, and the capture of a hundred Hedgehogs devouring pheasants' eggs would hardly justify the game-keeper's gibbet. I have seen a song-thrush peck a litter of harvest mice to pieces in hay-time, but I should not feel justified on that account (though harvest mice are dear to me) in shooting every thrush, and every bird I thought looked like a thrush, at sight. I should try rather to consider whether anything could be put to the credit side. Were a game-preserver to ask me to give an unbiased opinion as to whether Hedgehogs were destructive to game, I would answer that they were. That they would eat the eggs if they could crack them; the young, if they could catch them; and even the hen bird, if they could get a grip of her. I would say the same of badgers, foxes, stoats, weasels, otters, polecats, squirrels and rats. I would say the same of many birds, but I should try to present the case fairly, and, if I were successful, I should convince my questioner that the day when the last of the "vermin" was destroyed would be a bad day for "land."



THE SUCCESSIVE STAGES OF THE UNCOILING OF A HEDGEHOG FROM THE "NAUTILUS" POSITION.

The possibility of Hedgehogs preying on snakes is of some interest, and a few years back I had the curiosity to investigate the mutual relations between Hedgehogs and Vipers. More recently I have experimented with Hedgehogs and Grass-

snakes, but in neither case have I been able to come to any definite conclusion. In my first experiments I was only

A YOUNG HEDGEHOG.

once certain that the approach of the Hedgehog was unnoticed by the Viper. On this occasion Hedgehog sniffed at Viper (as he will sniff at anything he thinks may be eatable), and probably touched her with his nose. The effect, so far as Viper was concerned, was a quick cross-swing of the head and a vicious hiss. Hedgehog coiled instantly, and, by the time he had undone himself, Viper had withdrawn to a quieter place. On all other occasions I think that Viper sighted Hedgehog first. If she remained still, her eye and the tremor of her head were sufficient to keep Hedgehog at a respectful distance, but more often she retired in stately fashion as Hedgehog approached —anything for a quiet life. Hedgehog, even when fasting, would make no attempt to follow her up. In my more recent experiments with a Grass-snake (of which I give two illustrations), Hedgehog once succeeded in getting in a bite. In this case, too, Grass-snake was unaware of his approach, and the bite was evidently trivial, for she lunged straight at him. Hedgehog coiled up like a flash, and Grass-snake, trailing her whole length across his upturned quills, made for the nearest cover. There is little doubt, I think, that the Hedgehog, in order to eat a snake, must be able to come upon it unawares and break its back with a single bite. To be caught unawares the snake would almost certainly be coiled, and, for the Hedgehog to get in an effective bite, the coils would have to be favourably disposed; while the fling of a slightly wounded snake would certainly frighten the Hedgehog into a ball, and so give the snake a sufficient start to secure its safety. With quite young snakes, both viperine and others, the case is, of course, different. The stretch of the Hedgehog's jaws would accommodate any portion of their bodies, and I have no doubt that he is capable of pursuing, catching, and consuming them. It must be remembered, however, that Hedgehogs and snakes are seldom to be found abroad during the same hours of the day.

I have mentioned that the Hedgehog is a silent animal, and this is certainly the general rule, though I have at times been able to locate one by hearing a subdued snuffle in the grass—and the cry of a Hedgehog caught in a gin is said to

TWO YOUNG HEDGEHOGS IN A NEST.

be heartrending. This, I am glad to say, I have not heard. On one occasion, however, when I accidentally hurt a Hedgehog in an endeavour to keep him open, he uttered a sharp, spitting yap, and bit me rather severely. Under the

"Grass-snake was unaware of his approach."

"She lunged straight at him."

HEDGEHOG AND GRASS-SNAKE.

circumstances, the alternative method of defence may be forgiven him.

The Hedgehog probably has more than one litter in the year, each consisting of four or five young, which are born blind and, as one would naturally expect, without quills. The latter commence to appear within twenty-four hours. They are at first quite soft and scattered at fairly wide intervals. The spaces, however, fill up quickly, and in about a fortnight's time the little beast is fairly covered, as far as his back is concerned. The hairy portions of him take longer, and it is a full month before his quills stiffen and he can coil himself up like mother. Parents and young remain together for a considerable time, and I have more than once found a whole family hibernating together.

The two young Hedgehogs whose photograph is given on page 232, were the subject of rather an unfortunate experiment. The nest was discovered while some waste ground was being cleared, and as I was doubtful of being able to give the young ones the attention which young animals require, and yet was in need of Hedgehogs, I set a box-trap in such a way that the only entrance to the nest lay through it, and retired in the full confidence of being able to capture the mother. Some marauding beast, however, managed to scent the young ones during the evening, and on returning at midnight I found everything but the trap disturbed, and the young ones gone. I left the trap and caught what I presume to have been the mother on the night following, and what I presume to have been the father on the night after that.

DOUGLAS ENGLISH.

SOME COMMON BRITISH FUNGI

By MAUD U. CLARKE

Illustrated with Photographs by Henry Irving

BEFORE giving some description of the eight varieties of Fungi which are illustrated in this article, it would be well to consider, briefly, the main characteristics of the family in general.

The Fungi form an exceedingly interesting class of plants, the complexity of structure individually being much greater than is generally recognised, whilst the complexity evolved through adaptation to circumstance has resulted in so great a tribe of classes and sub-classes, orders and sub-orders, that very careful scrutiny, oftentimes with the aid of a microscope, is necessary before species can be determined. Nevertheless, there are so many who find pleasure in the beautiful form and colouring of the Fungi, without caring for comprehensive knowledge of the subject, that it will be to some purpose if the names of some of the more common species are given, and the reason why such species are divided into separate groups. From the point of view of colouring, taking a few varieties at random from certain classes, one can enumerate examples that are as brilliant as flowers, and quite as gracefully shaded and variegated. They possess, indeed, a range of colour that may be said to exceed that of flowers, since it passes down through orange to shades of tan and russet-brown to mushroom-black.

From the order of the *Russula*, there is *R. Virescens*, with emerald green cap and white gills and stem; *R. Linnæi*, with rose cap and yellow gills; *R. Azurea*, blue cap shading variably to green or purple with white gills; *R. Olivacea*, green cap with crimson rings; *R. Queletii*, purple cap with white gills, whilst *R.*

Nigricans gives entire colouring of deep velvety black.

The order of the *Agaricineæ* can show equally glowing colours, and of these I would mention two specimens that are frequently found together amongst dead leaves, etc., in our woods, viz., *Stropharia Æruginosus*, with turquoise blue cap and pale brown gills, and *Agaricus Violarius*, showing a crimson brown cap, salmon-coloured gills, and white stem.

Quite as wonderfully varied as the colouring is the exterior form of the Fungi. For here the range extends from the great Horse Mushroom of the *Agaricineæ*, or the coarse saddle-shaped forms of *Polyporus Squamosus*, down to the most fragile and minute species such as *Marasmius Hudsoni*, that lives on dead holly leaves. It measures about one inch in height, and curiously produces in miniature the suggestion of the holly's spines both on cap and stem. *Agaricineæ Setosus* will erect a crowd of delicate white pin-like forms only half an inch high on a single beech leaf. When we consider that every form of rust and mould, whether on the wheat-ears in our fields, or associated with food in our larders, is essentially a variation on the Fungus principle, it will be seen how large a family this is in its root-stock.

The development of species, or extension from any specialised manifestation, seems always to be the result of its capacity for adaptation to circumstance. The primitive *spore* became an extended and diversified manifestation according to the particular law of its circumstance. The original idea, persisting by right of its inherent life-power, is, nevertheless, conformed by the changed environment, and new variations of form, colouring, and structure are the consequence. Right at the heart of every expression of Nature there is always this great law at work—that of adaptation to circumstance. In short, to be able to conform to that is to be; to fail, is not to be.

There is no form of the Fungus order of plants, or, indeed, of any other plant or organism, but expresses this truth in itself very distinctly.

The Fungi belong to a very marked division of the order of plants. It is, indeed, so marked that some people scarcely think of the familiar Toadstool or Mushroom as plants at all. There is no point in all Natural History more interesting than the one where is discovered the emergence of one type-form from another—in other words, the link showing a vast relationship.

Deep down in the complexity of specialised form is also the warrant of relationship to the family-tree of the universal. Associated with that division of plants called *Cryptogams*, the Fungi are conspicuously separated by the absence of chlorophyll, or green colouring matter, in their constitution. This characteristic separates them from other plants, since it determines and limits their existence—they must feed upon organic matter, and not inorganic. The inorganic properties of clay, lime, etc., must have been first assimilated by another organism and transformed into chemical constituents nearer to the nature of the Fungus itself.

The two great divisions of the tribe are respectively: 1, *Saprophytes*, those that live on dead organic substances; 2, *Parasites*, those that live on living plants and animals. The fact of this subdivision shows at once what great power of adaptation to circumstance the Fungi principle possessed. Some regard them as descended from the *Algæ*, the primitive cellular plants that have been divided into three groups: 1, Algæ; 2, Fungi; 3, Lichens.

It is stated that these last became differentiated at a later period than the Fungi, being met with in fossil state in Tertiary rock, and having persisted ever since.

Two main groups divide the Fungus family: 1, *Ascomycetes;* 2, *Basidiomycetes*.

The first is the elder in point of time, showing in the organisation a closer resemblance to the *Algæ*, the old universal ancestor. It is from this ancient order of the *Ascomycetes* that the species shown in the illustration on page 241 is descended. The other seven specimens illustrated all belong to the group of the *Basidiomycetes*. Since the determination of species depends upon the structural formation, a little should now be said upon this important matter.

The general construction of the *Hymenomycetes* may be considered from the appearance of the well-known Mushroom as a type, the organisation and reproduction scheme being the same. This class includes nearly all the larger Fungi, the name having reference to the plant possessing a fruit-bearing surface. The Fungus possesses: 1, *Mycelium*, or body; 2, *Receptacle*; 3, *Reproductive organs*.

THE FLY AGARIC.
Common in Birch and Fir woods. The cap is at first blood-red in colour.

The flesh-coloured gills of the Mushroom have the *Hymenium* or fruit-bearing surface spread over them in the earlier stages of its growth. Upon that surface are the *sporophores* which bear the *spores*, or seeds; generally four in a group, and possessing rudimentary stalks. These *spores*, when germinated, produce again a *Mycelium* possessed of the same apparatus.

All the classification of Fungus types is very commonly determined from the character of the *spore*.

In the genus *Agaricus* there is division into five series, determined by the colour of the *spores* as white, pink, brown, purple and black. The white-spored species are the highest in type—firmer and more persistent than those having coloured *spores*. With the last-named there is a tendency to collapse easily, especially in the case of the black *Agarics*. As compared with other plants, the Fungi present a singular phantasy of being, possessing often an ephemeral existence largely characterised by the matter from which they are expressed. Sometimes one species is found preying upon the decaying substance of another, such as the slender silver-grey *Nyctalis Parasitica*, with long curving stems springing from a stout russet-brown variety of *Agaricus*.

Without going further into the profundities of the construction and exterior character of the *spores* themselves, the under surface of the Fungus must be considered. The character of the gills, or *Hyphæ*, as they are termed, is most variable, and forms definite class distinctions.

In the *Agarics*, and allied types, the gills are of loose flexible character, whereas in the perennial Fungi they become very densely compacted, sometimes cork-like, or even hard as wood itself. Other species, again, have a granular liquid secreted in the *Hyphæ* resembling milk, from which fact the genus is called *Lactarius*.

The character of the stem, or *stipe*, the absence or presence of the ring upon it, the margin of the cap, or *pileus*, and general shape, the quality of its flesh and colouring beneath the outer pellicle, are all matters of consequence in classifying species. The stem may be solid, semi-solid, or hollow, possessing a bulb-like base, rootlets, or a long tap-root.

The first illustration gives a good idea of the Fly Agaric, classified as *Amanita*

THE "SCARLET HOOD."
Common in grass. The cap is scarlet above, shading to orange and yellow below.

Muscaria, or *Agaricus Muscarius* (Linn.). The former manner determines the additional fact of the species belonging to the *Amanitæ*, a sub-division of the large order of the *Agarics*.

It is a very showy plant, and common in our birch and fir woods. The *pileus*, or cap, is a vivid blood-red at the first stage of expansion, becoming more orange later, and paling in colour when old. Its early form is globose, then convex, and lastly flattened, with fragments of the white *volva*, or universal wrapper, scattered on the surface. Beneath the outer skin the flesh is white, together with the stem, which at an early stage is filled with fibrils, but soon becomes hollow. The base is bulb-like, with rings of scales running round it. The "ring" is large, soft, and torn in shape, inserted at the apex of the stem and hanging down upon it. The illustration unfortunately fails to show this ring owing to the surrounding mosses. The gills are what is termed free in character, but touch the stem; the colour is white, though rare instances of yellow may be met with. The average breadth of the *pileus* is from 3 to 7 in.; the stem 2 to 9 in.; although some have written of specimens measuring 20 in. across the cap and standing 3 ft. high.

THE "PRICKLY CAP."
Shown growing on a tree trunk. Its colour is yellow, with bright tan scales.

It is a poisonous species, the narcotico-acid producing intoxi-

cation, delirium and death, although considered less deadly than others of its order. The taste is bitter, and there is comparatively little scent. It is to be found in most districts from July to November.

Commonly known as the "Prickly Cap," the *Pholiata Squarrosa* (ord. *Agaricineæ*) is shown on page 237 in its usual habitat, a tree trunk (frequently an apple tree). It grows in tufts, and appears from August to October, being common to most districts. The *pileus* varies from 2 to 4 in. across, and is tawny yellow in colour; it is very scaly, at first bell-shaped, rounded, then convex when expanded. The top has a suggestion of the central boss, which is emphasised more or less in different species as a variable character. The scales are a bright tan brown and add to the distinctive colouring. The stem measures from 3 to 6 in., is yellow at first, then becomes brown; it is thick, smooth above, and rough below. The ring, seen plainly upon the two topmost specimens, is set high, and is also a bright brown colour. The interior of the stem is fairly solid and of pithy construction. The gills change in colour, being yellowish in the early stage, olive-coloured later, and eventually brown; they are unequal, and bow-shaped in form; the *spores* are brown. Regarded as a wholesome species, the "Prickly Cap" cannot claim to be of first-rate quality, the taste being rather that of mouldy meal.

BOLETUS VARIEGATUS.
To be found chiefly in Pine woods. Dark yellow in colour.

The "Scarlet Hood," or *Hygrophorus Coccineus* (ord. *Agaricineæ*), is another common species, frequent on grassy places in scattered groups from August to November (see page 237). The *pileus* measures from 1 to 2 in. across, and is scarlet above, shading to orange and yellow below. It should be remembered that the colouring of the Fungi is variable, and the gills may even assume a pinkish tone. The cap is conical, bell-shaped, slightly bossed, and when expanded sometimes splits from the centre. The inverted specimen on the left of the group shows the formation of the gills excellently. The principal difference from all other allied species lies in the *hymeneal* stratum of the gills becoming a waxy mass removable from the *trama*, a substance existing between the two plates of the gills. It is specially noticeable in this species, the gills seeming full of watery juice. They are yellow or red, broad and swollen in the middle. The *spores* are white; the stem, from 1 to 2 in. high, is yellow streaked with scarlet; thick, smooth, tough, yet easily split, and hollow in the centre.

The species is edible, has no scent, and is of good flavour.

Boletus Variegatus (ord. *Polyporeæ*) is a species found chiefly in our pine woods through September and October. The *pileus* is 3 to 5 in. broad, dark yellow in colour, and in form convex, then flattening; it is slightly moist, and sprinkled with small hairy scales. The

stem, from 2 to 3 in. high, is thick and firm. The colour is dark yellow and sometimes reddish. The tubes are unequal, with the pores minute, brown at first and then cinnamon.

The reversed specimen in the illustration on p. 238 shows these fine pores as suggestive of pin-pricks, covering the entire under surface of the Fungus. Although generally regarded with much suspicion as a poisonous "toadstool," it is in reality one of a large species of wholesome Fungi. The size and abundant growth of the *Boleti* provide a considerable quantity of food that is ignored, to the great regret of those who have largely explored the question.

In *Dædalea Unicolor* (ord. *Polyporeæ*) we have a very distinct departure in growth and general appearance, yet a species maintaining the principal character of its order among Fungi in the manner of the fruit-bearing surface lining the interior of tubes or pores. Looking at the isolated specimen to the left of the photograph on this page, one can more easily recognise that the *pileus* is of intricate construction, the curled edge being waved in outline, and in addition re-curved upon the *pileus* itself. *Dædalea* expresses the idea "curiously wrought." This complex border of the plant even becomes torn into jagged teeth. The colouring is a very beautiful variation of ash-grey with white extensions; the *hymenium* is whitish grey, while a section shows a greenish colour. The *pileus* exhibits zones, or rings, of the same colour, with variable shading. It is commonly found on tree-stumps—particularly birch; and also, as in the illustration, growing over the mosses and dead *débris* of the woods.

DÆDALEA UNICOLOR.
Commonly found on tree-stumps—particularly Birch. Ash-grey in colour.

The isolated specimen also shows very clearly the character of the under surface, and the tubes wherein the *spores* are expressed.

Stereum Hirsutum (ord. *Thelapherei*) is a plant familiar to everyone, for it is to be seen practically all the year round growing on decayed tree-stumps. The base, or part nearest the stump, is fre-

THE "PUFF-BALL."
Dirty white in colour, changing to brown.

TEREUM HIRSUTUM.
Grows on decayed tree-stumps.

quently greenish, passing into a pale ochre border, with fine brown lines upon the upper surface, marking zones. In the early stage of growth the plant does not show the hairy character. The margin is blunt, sometimes a clear white colour, when the stump appears to be elaborately

or rarely single, the *spores*, when ripe, forming a mass of powder. The photograph on p. 240 shows the various stages of growth—from the early globular form to the more pear-shaped one, giving the distinctive title of *pyriforme* to this species.

At first the Fungus is covered with

XYLARIA HYPOXYLON.
Shown growing on moss on a Beech stump.

decorated with braiding. The surface is wrinkled and reflexed, and the *hymenium* beneath even, smooth, yellow in colour, and without juice. It is a perennial species mostly, coriaceous or woody; the *pileus* is leathery, and generally 3 to 5 in. across, being arranged in close groups one over the other in tile fashion.

The "Puff-ball" species, *Lycoperdon* (ord. *Gastromycetes*), belongs to the second of two main groups dividing the *Basidiomycetes*, viz., *Hymenomycetes* and *Gastromycetes*. The construction of the *hymenium* of Group 1 has already been dealt with; in Group 2 this fruit-bearing surface is enclosed until the *spores* are ripe and ready to be dispersed. The *Lycoperdeæ* form one of the seven sub-orders. The skin, or *peridium*, is double, minute pointed warts that give a frosted appearance to the surface; later, they disappear before the bursting of the ball, which takes place from the mouth indicated in the large specimen at the right-hand base of the picture. It is an edible, rooting species, possessing long white branching fibres. The colouring is dirty white changing to brown, the flesh dingy white transformed later into the brown dust of the *spores*.

The curious-looking growth of tooth-like forms upon the moss shown on this page represents a common species descended from an ancestor older than any of the preceding illustrations. It is the one example given from the primary group of the *Ascomycetes*, all the remaining seven being descended from the *Basidiomycetes*.

The *Xylaria Hypoxylon* (ord. *Sphæriaceæ*) is corky in substance, and is either simple or branched. The photograph shows a growth, in the right-hand top portion, branched distinctly into three, as well as many examples of the simple form. The branching extends considerably beyond this, the group representing the plant in an early stage of growth; it is then pulverulent on the surface, having a white mealy powder upon it, which later on disappears and the colouring becomes black.

The black base is clearly distinguished in the foreground group to the left of the picture, where the tree-stump is sliced off at an angle. The two leaves in the immediate foreground are of value in suggesting the size of the Fungus. In the stages of its growth, the *Xylaria* expresses something of the advancement of all plant growth onwards from a primitive, or very simple blunt form, to the more complex one of extended branches and branchlets upon those branches. In the simple blunt form that first arises there is a conglomerate of cell-structure that, becoming checked in its direct upward growth, forces again forwards laterally and vertically as two or more distinct portions. These in their turn repeat the impulse, adding to the character of the plant.

MAUD U. CLARKE.

LIFE HISTORY OF A MOUNTAIN—I

By J. LOMAS, F.G.S., A.R.C.S.

THERE is a group of insects—the Ephemera—whose lives are compassed about by a single day. In the morning they are born, during the day they go through all the functions of life, and die with the setting sun. Imagine one of these creatures, endowed with powers of thought and reasoning, spending its brief existence on an oak tree. Of its own knowledge what could it know of the acorn, the unfolding leaf, the bare branches and winter's snow? It would naturally regard the oak tree as the very emblem of stability—immutable and everlasting.

So man, when he considers the Earth on which he spends his little day, would be prone to look upon the features of the Earth's crust as unchanging, if he were guided solely by the light of his own experience. Even if he were acquainted with the accumulated experiences of past generations as recorded in the writings of his predecessors, the changes would be so slight that they would scarcely be noticeable.

But the Earth has written its own story in the rocks of which it is composed, and if we can read only a little in this great "Nature book" we find that the dominant note is not stability, but change.

Mountain, valley, river and sea are only the present-day phases of many scenes which have begun and ended in the past. Tennyson's well-known lines record a scientific fact:

> "There rolls the deep where grew the tree,
> O Earth, what changes hast thou seen!
> There, where the long street roars, hath been
> The stillness of the central sea."

In the great operations of Nature, *time* is an important factor. Changes may be going on about us with such exceeding slowness that we do not perceive them. In our blindness we speak of the "everlasting hills" and "the ever-changing sea," and yet by a strange irony the sea-level is the only datum line which can be regarded as approaching to stability, and it has been universally employed as a means of recording the height of the land.

Photograph by R. Pettitt, Keswick.

"MOUNTAIN, VALLEY, RIVER AND SEA ARE ONLY THE PRESENT-DAY PHASES OF MANY SCENES WHICH HAVE BEGUN AND ENDED IN THE PAST."

Buttermere.

It has been found, however, that it would not do to use mean sea-level indiscriminately and at any place as a starting point, and so the Ordnance Survey in preparing the maps of our country were compelled to adopt a certain line, which they considered, after careful and prolonged observation, to represent the mean sea-level at the Old Dock Sill at Liverpool.

"THE STRATA . . . MAY BECOME TILTED INTO AN INCLINED POSITION."

It may be asked, by what signs do we know that the Earth's surface is subject to changes of level ?

In many parts of our coasts, and more particularly on the west coast of Scotland, we meet with low platforms extending seawards from inland cliffs. In all respects they are like the beaches now being formed on the shore. The sands and gravels of which they are composed contain the remains of marine shells; yet they are never covered by the highest tides, but stand high and dry twenty-five to fifty feet above the present sea-level. In other countries ancient beaches have been raised to a height of many hundreds of feet.*

While these may be looked upon as proofs of the elevation of the land, forests of oak, poplar, pine and other trees which are now submerged under the sea at high water, convince us that the land has been depressed in other parts of our coasts.

On a grander scale we find ancient sea deposits among the highest peaks of the Alps and the Himalayas. We cannot stop to inquire when and how these great changes took place; it is sufficient for our purpose to know that the Earth contains within itself forces sufficiently powerful to crumple the Earth's crust into ridge and furrow, and continent and ocean alike bear witness to the vast energies existing, but not slumbering, beneath our feet. In the gradual exercise of these energies mountains have their origin.

In tracing the history of a mountain, let us assume that the sea bottom is in process of gradual elevation.

The infant mountain has scarcely emerged above the waters before it is subject to forces from the outside which tend to reduce it to a lower level. During growth these same destructive agents are at work, and they cease not when it has attained its full stature and strength.

In the end they prevail, and the mountain is once again removed into the midst of the sea to form "the dust of continents to be."

Thus, like most of the operations of Nature, the events run in cycles, and return to the point from which they started.

In considering the cycle of events through which mountains pass, we must keep full in view these two conflicting elements: one working from within tending to uplift, the other from without tending to destroy.

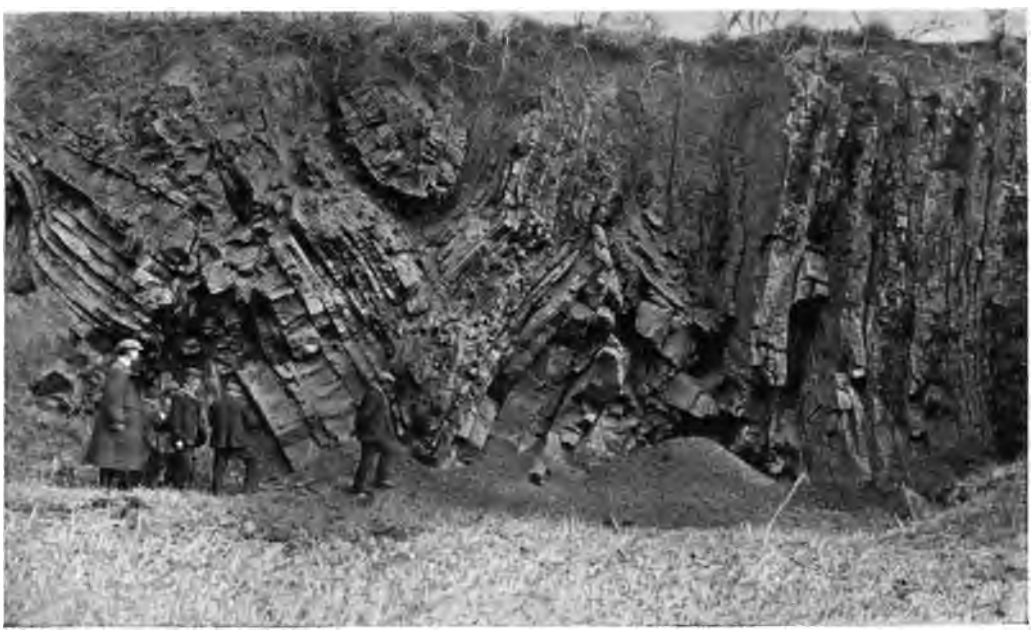
The character and disposition of the material on which these forces play are also important in determining the form which the mountains assume.

Some rocks, such as granites, have been solidified, by cooling, from a state of fusion. They are usually compact and homogeneous, and offer few points favourable to attack. Their weakness chiefly lies in the cracks and joints, which develop as the mass shrinks, and they are susceptible to chemical decay.

Other rocks such as sandstone, limestone, shale and slate are commonly laid down in layers or strata. It is seldom they preserve the same characters through

* *See* "Waves and Their Work," p. 221.

"BENT INTO FOLDS WITH CRESTS AND TROUGHS LIKE THE WAVES OF THE SEA."
Sawley, near Clitheroe.



"CRUMPLED UP LIMESTONE BANDS."
Foxley Bank, near Clitheroe.

THE GRANITE PINNACLES OF THE MOUNTAINS OF CORSICA.

any considerable depth, but show alternations of strata with varying degrees of resistance. It is a common saying that the strength of a chain is the strength of its weakest link. The same holds good with rocks of this class. A layer of soft yielding shale interbedded with more durable limestone or sandstone may cause the whole to decay as rapidly as the shale itself.

As a rule, the strata are laid down horizontally, but in the process of mountain building they may become tilted into an inclined position or bent into folds with crests and troughs like the waves of the sea.

It has been proved, experimentally, that many rocks which would break with a sudden blow will bend if the pressure be applied very gradually and continued for a long time. Hence we do not postulate that a sudden or violent force has crumpled up the limestone bands shown in the photograph on page 245, but rather a gradual pressure lasting through immeasurable time.

If the distorting forces act more rapidly, we get fracture instead of bending, and great blocks of rock, sometimes miles in extent, may slide over each other along the line of breakage. Displacements of this nature are called "faults."

The grinding of great rock masses over each other also results in other effects than mere displacement. Vibrations are set up in the adjacent rocks which produce the phenomena of earthquakes. As many thousands of earthquakes occur in the Earth's crust every year, and each one of these results from the fracture and slipping of strata, we see that the Earth is still subject to great stresses, and is constantly accommodating itself to them.

Now let us consider the external forces whose office it is to degrade the land.

"MASSES OF GRANITE MAY BE SHATTERED INTO FRAGMENTS AND LIE ABOUT, A PICTURE OF RUINOUS DECAY."

Frost, sun, rain, river, glacier, sea and wind are the principal agents of destruction.

A mason in sculpturing a block of stone begins by chipping away flake after flake until the desired shape is roughly attained. Then he uses finer tools to produce more detailed outlines, and the final effects are secured by polishing.

So in rock sculpture—frost and sun do the roughing out, and the other agents principally act as finishing tools.

The effects of frost are mostly felt in high latitudes and at great altitudes. We know from personal experience the effects of water freezing in our domestic supply pipes. We may not discover that the pipe has been broken until the thaw comes and the water floods our dwellings. In the same way, the water contained in the crevices of rocks expands on freezing, with almost irresistible force, and shatters even the hardest material into fragments; the flakes are held fast until the spring comes, and then the *débris* rains down to form a talus of stones at the base of the slope. We see the work of frost-flaking in the granite pinnacles or aiguilles of the high Alps, the mountains of Corsica,* and in all compact rocks subject to great cold.

In our latitudes it is hard to realise what sun-flaking means, but standing under the tropical sun, and face to face with the riven rocks, it becomes very real. During the day the stones become intensely heated and expand; at night, when the sun's rays are withdrawn, they rapidly chill and contract. Thus by alternate expansion and contraction even masses of granite may be shattered into fragments and lie about, a picture of ruinous decay.

The agents engaged in finishing the work roughed out by frost and sun are more influenced by the texture of the material on which they operate. The softer parts rapidly decay, leaving the framework of harder rocks standing like a bony skeleton stripped of its covering flesh. Moving water, ice and air can do little of themselves. It is the harder material they carry in suspension which

"LEAVING THE FRAMEWORK OF HARDER ROCKS STANDING LIKE A BONY SKELETON STRIPPED OF ITS COVERING FLESH."

* See also the coloured plate of Mr. MacWhirter's picture, "June in the Austrian Tyrol," in Part 3.

is really effective in abrasion and polishing.

We have seen that moving water in the form of a river can cut gorges and excavate wide valleys. The sea, when lashed into great waves, not only hurls huge masses of water against the cliffs, but bombards the rocks with showers of stones; it is these missiles which drill caves and isolate stacks.

When we come to discuss valleys we shall see how important are the effects of moving ice in moulding the contours of the land. In some parts of our own islands the tool marks of ancient glaciers are still to be seen.

"THE DRIVEN PARTICLES ETCH OUT THE SOFTER PORTIONS."
Sand-etched rocks at Burton, Cheshire.

We can study the effects of moving air in a dusty road or on a sandy beach. The wind catches up grains and flings them against any object in its path. In this way windows of dwellings and lighthouses facing a sandy beach become frosted by the natural sandblast. If the obstacle is not composed of material of equal hardness, the driven particles etch out the softer portions and leave the harder standing out from the face.

By long continued action great rock masses once continuous become severed and expose the interior to denuding forces.

J. LOMAS.

Photograph by G. Bingley, Headingley.

"MASSES ONCE CONTINUOUS BECOME SEVERED."
Brimham Rocks, Millstone Grit.

ANNE HATHAWAY'S COTTAGE.
From the Painting by A. C. Wyatt.

RIPENING TO HARVEST.

THE HUSH OF THE CORN

By ARTHUR SCAMMELL

WINTER evening in Wiltshire Downland. A faint glow at the edge of the flat cloud ceiling in the south-west; home-going rooks in ones and twos and stealthy clusters, slowly flapping their way over the table-land, and sinking downwards to their roosting-places in the trees of the park and churchyard, their Good-night cawing mingling with the chime of the tower clock as it strikes the hour of four.

The long, long stretch of unbroken turf, the virgin pasture of the hills, comes here to an end, and a vast field of upland arable drops in a gradual slope to the valley.

Cold and barren are the winter downs—"High tops bald with dry antiquity"; inch-long grass blades, stunted furze-bushes, and wind-warped thorns, pale ghosts of vegetation, are all that grow there; yet this ploughed land, this desolation of frozen clods and thickly-strewn flints, seems barrenness itself and makes the downs luxuriant by contrast.

And now cold grey fog fills the air, making the twilight weirdness of the scene more weird; and, standing there closed in by those vaporous walls, the wayfarer falls into a kind of maze: he feels as one out of touch with time and space.

This surely is never friendly Wessex soil; rather some "waste land where no man comes nor hath come since the making of the world." A stillness as of the Ancient of Days, before that impertinent accident called Life had appeared, to break, for a feverish hour, the eternal silence: a strangeness as of some far-distant planet where warmth and movement could never be; or some ghostly plain ringed about with the frozen mountains of the moon.

Photograph by Frith & Co., Reigate.

THE CORN-FIELD PATH.

Faint, far-off sounds—the barking of a dog, or bleat from a sheep-fold—though sufficing to set the steps mechanically in motion, do not serve to bring the fancy back from these "wanderings in worlds not realised," and as the darkness deepens, the strange sense of desolation and "other-worldliness" increases.

But suddenly the eye falls upon a tiny spray of green upon the frozen ground; there is another, and another: this seeming barren plain is teeming with new life; thread-like rootlets are striking down to find the waters under the earth; the adamantine crust is pierced by myriads of fairy spears. Straying fancy comes home; the ghostly lunar desert resolves itself into a plain Wiltshire plough-field; and that eerie stillness which had seemed the lifelessness and silence of some far-away planet is but the winter Hush of the Corn.

* * * * *

Again the familiar hills, and the stroke of the clock which has meanwhile marked so many hours of toil and rest for the village below. Again the edge of the downs and the beginning of the wheat. But there is no crossing the field now, for midsummer has come; a genial season has favoured the crop, and waist-high spreads the sea of living green: a little scantier on the upper edge of the field, where the plough has thrown the earth downhill, and the stalks spring out of the dry and crumbling chalk; but beyond, as the soil increases in fatness, thickly serried, full, and juicy with a deep blue-green bloom upon curving blade and rigid

stem, stand the noble plants, the finest product of the earth.

In the most backward stalks, where the ear has not fully emerged, the sheath is strong and full of sap; but where, strengthened by a few days'—or, perhaps, a few hours'—exposure, the ear no longer needs protection, the hanging sheath is already withered at the point, the nourishment that had gone to support the blade being, in the perfect economy of the plant, at once directed to the growing grain. Notice, too, how carefully the enclosing husk shelters the delicate process of bloom and fructification now going on, the withered and useless parts only of the tiny florets being exposed to the air.

How prolific, too, is the wheat. An ear of barley consists of two lines of corns in single succession, but the wheat ear is studded on both sides of the stalk with closely packed bunches of four or five corns each—the proper number is five, but the middle corn suffers from overcrowding, and is commonly abortive—so that a single ear will yield from seventy to a hundred grains.

An hour with the wheat. An hour of pleasant lingering, of release from that tyranny of the commonplace which makes us think by rote and act by mechanism; an hour for resuming one's birthright freedom in the great liberty of the Universe.

It is a glorious evening: such an one as flushes the mind with a sense of beauty, and leaves a high-water mark in the caves of memory.

An immeasurable span of sky, its depth of colour just stained at the zenith by a faintest wave of cirrus cloud; a feather cast from some wandering wing of heaven, and floating upwards, too light and pure to fall.

And yet the earth seems well-nigh as clean to-day as the sky; the white chalk soil and the shining green of tree and herb and grass that deck it; the flowers that spring, the flying swallow and the lark, seem all to have put on some of the glory of the sky and air; and the subdued murmur of life which makes the summer air tremulous, sounds grand in the ear, as it were the hum of the great earth spinning upon its axis.

Pass around the field to where, on the western side, the corn is bounded by a grove of ash and sycamore, and there sit in great content, too happy even for castle-building, for what could one imagine better than this blessed reality? And so the hour passes, and another, and the long shadows grow longer and creep across the corn-field and up over the downs, and away into the upper sky, and the glory of afternoon glides into the peace of evening. And as glow and colour leave the sky, and the ardour of the poppies abates, the broad green harmony of the wheat-field more and more entrances eye and mind; dark below, with a soft, pearly sheen above, perfect in mass, perfect in detail; spacious, wide-spreading like the sea, yet homely as the cottage border. The peace of unnumbered ages slumbers upon it. A peace which endures even through the ages of violence: though ruthless deeds may ravage the world, yet the corn-fields will not all be dyed red: the sorrow of many that sow in tears will be comforted by the touch of Mother Earth, and somewhere on quiet hills the harvests of peace will be garnered.

How many sweet associations of rural summer time are suggested by this tranquil scene: the joy of many generations of poppy-gathering children; the happiness of lovers' evening walks, and the sense of rest which falls with the dew upon the head of the tired labourer; the beauty which rises with the sun, and the tenderness of moonlit hours.

To the continuous chorus of the day succeed the quiet notes of evening, the call of the partridge from the hill—

> "With distant echoes from the fold and lea,
> And herd-boys' evening pipe and hum of housing bee,"

whilst again from the valley comes the sweetly solemn sound of the church clock striking the hour. And the lingering sound of the bell, the closed eyes of the flowers, the dreaming of ancient oaks—

> "Branch charmed by the earnest stars,"

the last brooding note of the dove; all the gentle words and looks whereby the parting day bids Good-night, seem

gathered up and expressed in this perfect stillness of the wheat-field: the summer Hush of the Corn.

* * * * *

Out on the Upland, the August heat of the sun, great as it is, serves in no wise to oppress, but rather to inspire and hearten: the fire which has burnt through the wrappings of the sunflower, and made of its ripening breast a mirror for its own glory; which has kindled the hollyhocks of the garden into living torches, and cast the harmless brands of the poppies amongst the corn, seems to shine with happiness widespread as its light, and to make the glowing air a very elixir of life.

THE TIME OF HARVEST.

Looking at the long rows of stooks ("aisles" we call them in euphonious Wessex), and at the busy clusters of men and women about the wagons in the field, the thought comes that if only men could be persuaded to live by bread alone—content to satisfy their hunger and starve their lusts—how easy and pleasant a thing life might be made; even the primal imposition of labour proving a blessing rather than a curse.

But the cultivation of the wheat, easy as it is to us who enter into the labour of others, must have had a hard enough beginning.

All around the field grow the grasses, now dry and seeded, the poor relations and ancestors of the corn—oat grass, rye grass; their names and appearance are sufficiently suggestive, and we hardly need the botanists to tell us that from one of the humble tribes of these grasses the noble family of the grain has sprung. How we plume ourselves to-day on the skill shown by our gardeners in producing new and strange varieties of fruits and flowers: turning chrysanthemums into dahlias, dyeing the sweet lavender of the scabious with a lurid crimson, and producing weird hybrid fruits, neither blackberry, currant, nor good green gooseberry. But what are these triumphs of to-day compared with this work, done long ages before the dawn of history: this turning of tares into

good seed, this making of bread out of nothing?

The story of the hero who brought fire from Heaven for the service of man has come down to us, but what of the greater than Prometheus who entered into council with the Earth and "the maturing sun, conspiring with them how to load and bless" the sons of men with this gift of gifts?

Was he some savage genius watching, and taking a hint from the bird he meant to snare, as it pecked the seed off the dry grass? Perhaps—and many a savage has no doubt before now made shift to stay his hunger with bird seed—but the prophetic insight, the skill in husbandry, and the patience necessary for carrying out such a tedious course of cultivation and development, bespeak savagery of a noble sort indeed.

Native American legend—by the mouth of Longfellow—tells us the story of the beginning of the maize: how that Hiawatha, son of the West wind, in a time of famine was visited on three successive nights by a beautiful youth, who challenged him to wrestle. Each time the youth was overthrown, and on the third night lay dead upon the ground; but before the final combat he foretold the issue and bade Hiawatha bury his body and watch and tend the grave. So Hiawatha laid him in soft earth and uprooted the weeds, and scared away marauding birds and animals—

> "Till at length a small green feather
> From the earth shot slowly upward,
> And before the summer ended,
> Stood the maize in all its beauty,
> With its shining robes about it,
> And its long soft yellow tresses."

Perhaps the savage people which could produce so beautiful a story might, after all, be equal even to this greatest of human achievements—the evolution of Corn.

Photograph by S. H. Wrightson, Streatham Hill.

"THE SLOW-MOVING WAGONS GATHER UP THE LONG RANKS."

On the margin of the field, from a lonely ash is heard the little song of the yellow-hammer. Perhaps the aspect of the scene—a vast expanse of cornland, with never a glimpse of a milk-suggesting meadow—gives an additional poignancy

to the burden of his complaint: "Little bit of bread and *no* cheese."

In the corn yet standing the sparrows are busily taking their toll: poising for a moment and choosing a stout stalk, they grip it with their claws just beneath the ear, and hang sideways whilst they deftly pick out corn after corn. One would hardly suppose such portly little bodies could be sustained by so frail a support, but no doubt these little acrobats are masters of equilibrium.

So the day goes on, and the work. The slow-moving wagons gather up the long ranks, and the great rick in the lower corner of the field grows apace.

Easy the work may seem, but not so easy is it in the doing. Sheaves are slippery things, and to pile a waggon with a towering load so that it will ride in safety, rocking and swaying over rough and hilly ground, is not the work of unskilled labour.

The rick, too, is something of a work of art; the builder uses no plummet and line, and, standing as he does upon his work, has no view of the growing outline to guide him. An occasional call to a "pitcher" on the ground, "How's the rick a'gwain, Thomas: is ur toward or vromard?" "Middlin', Jan: a bit toward, mabbe," is all the help he gets. Yet look at the shapely stacks, especially those that stand on "staddle stones," that cluster round the farms in Autumn: sheer curves of beauty, some of them, and well deserving the crowns of plaited straw with which old-fashioned thatchers used to top them.

The field is large, and night falls with the crop ungathered. The labourers ride home in the wagons, women and children amongst them, the latter with their little limbs well stubble-scratched; but they have decked their rusty straw hats with bindweed, and carry treasures: perhaps a tiny red harvest mouse or two, wide-eyed and panting with fright, to be the pets of a week.

All are tired, but happy; for though Harvest has no longer the deep significance of old times—expressed in merry-makings and rustic ritual—yet the ingathering of the crops is still, and always must be, felt to be a blessed and happy work.

The call of the moonlit downs draws one out for a ramble. The dew lies heavy, and the cool air of the heights is a draught more precious than wine. How black are the shadows of the furze bushes, how full of mystery the darkened coombs, and all the hill region a very home of romance. If those smooth barrows would but reveal the secrets they hold so closely, and the weather-worn and lichen-spotted stones tell their tale, what stories of earth's wonders and the dim beginnings of man would be unfolded! But with the secret divulged, the charm would be gone; so let the sepulchres remain sealed, and the stones keep that silence of the ages, more eloquent than words.

And upon the corn-field, too, the spirit of the past has laid its hand; reared yesterday, vanished to-morrow, with the caressing of scarcely faded flowers still about them, yet these groups of sheaves seem old as the hills: peaceful tents in which slumber the ghosts of all the ages of agriculture: the health and innocence of the husbandman's life; strength of the men who laboured, patience of women who gleaned; is it not all here? The dewdrop on the stubble, a tear wrung from the sad heart of Ruth; and the cornflower with a deeper blue to-day, caught from the eyes of Highland Mary, as she bound the sheaves for her lover.

Deep and all-pervading is the spell of the moonlit scene, and here the very centre of the mystery: earth and air, the stars, the hills, and the restless heart of man, all held in enchantment by the midnight Hush of the Corn.

ARTHUR SCAMMELL.

HOW TO KNOW THE INSECTS

By JOHN J. WARD

Author of "Some Nature Biographies," "Peeps into Nature's Ways," etc.

Illustrated from Original Photographs by the Author

CONSPICUOUS INSECTS OF SUMMER-TIME

THERE are many insects that appear about midsummer which attract observation either by reason of their size, or their brilliant colours, or, in the case of some, by their ugly, perhaps repulsive, appearance, and in this paper I propose to deal with insects of this order. My greatest difficulty is to select from the thousands of common British species those which are most likely to be met with, and which will best serve to instruct in the principles of observation of insect life. Having in my previous contributions described in detail a few examples of insect metamorphoses and mimicry, as well as some general distinguishing features, I shall probably not go far wrong now if I deal with insects that more or less force themselves on the observation, when they appear at all.

As butterflies are, perhaps, the most attractive among British insects, we may first consider a very abundant woodland species, the male of which is almost invariably seen displaying his bright sienna or orange-brown wings along the sunlit glades during July and early August. The insect is shown in the first illustration, and is known as the Silver-washed Fritillary (*Argynnis Paphia*). It is, however, the female insect that appears in the illustration; she is more often seen near the ground (the photograph shows her on a stem of clover), occupied with the business of egg-depositing amongst the leaves of the dog violet, and occasionally the sweet violet. Her mate flashes his brilliant colours and endeavours to attract her into the sunny open spaces where they can take long and swift flights together, and then feast on the nectar from the bramble flowers. Both insects have their wings spotted and marked with black, and the female very much resembles the male, only that her brown colour is not nearly so brilliant.

In the illustration on page 257 is seen another example, photographed just in the act of climbing a clover stem. It should be observed that the butterfly has only four walking legs, its fore-legs being rudimentary. This little observation at once gives the information that it is one of the *Nymphalidæ*, and also that in its chrysalis stage it was suspended upside down by its tail end, a peculiarity which we previously noted in connection with the White Admiral Butterfly. This is an instance of the use to be made of the details of classification given in a previous paper which, at the time, perhaps, may have seemed a little unnecessary. I had better add, however, that if this had been a male butterfly, greater care in arriving at our conclusions would have been needed, as in the family *Erycinidæ* the male butterflies have four perfect legs and the females six, and the chrysalides may be raised or suspended; but as there is only one British representative of this family, viz. the Duke of Burgundy Butterfly (*Nemeobius lucina*), this is a point of importance only to the clever and precise critic who, after his wont, might come down upon me had I not modified my statement.

The under sides of the wings are green, and, as the illustration indicates, are conspicuously marked across with wavy bands of silver; hence the insect's popular name. The Silver-washed Fritillary is one of the largest of British butterflies;

it often measures nearly three inches across its expanded wings.

While we are moving about amongst the clover blooms, another brightly coloured insect may often be seen and perhaps be mistaken for a butterfly. There suddenly sounds on the ear a buzzing noise, something like that of a fly, and one or more insects like those shown on the clover-head in the next illustration appear. The photograph gives no idea of the beauty of these insects; their fore-wings are metallic blue or green that glitters in the sunlight, but looks black when seen in shadow, and on each of these dark wings appear five spots of carmine red. The lower wings are of the same red colour edged with a narrow border of the dark metallic green seen on the fore-wings. This insect is the Narrow-

FEMALE SILVER-WASHED FRITILLARY BUTTERFLY.

bordered Five-Spot Burnet Moth (*Zygæna Loniceræ*).

This is a particularly interesting moth for the tyro in entomology to observe, because it apparently offers some contradictions to general rules. In the first place we have here a moth that possesses colours as brilliant as those of a butterfly, and also behaves like a butterfly, flying only during brilliant sunshine and resting during dull days and at night. Moths in a general way are creatures of the dusk and night, but here is one of the many exceptions to that rule. Also, the antennæ should be observed. These, at first glance, appear to be clubbed at their ends, like those of butterflies; careful observation, however, will show that, although they are thickened somewhat, the actual end of the club is pointed, as in all other British moths. The attitude assumed when resting, too, is that of a

FEMALE SILVER-WASHED FRITILLARY BUTTERFLY CLIMBING A CLOVER STEM.

moth. Therefore, these apparent butterflies are only day-flying moths. There are several species of Burnet Moths, such as the Broad-bordered Five-Spot (*Z. Trifolii*) and the Six-spotted (*Z. Filipendulæ*), the popular names indicating the differences in the markings of their wings.

TWO FIVE-SPOT BURNET MOTHS ON A FLOWER-HEAD OF CLOVER.

In the districts where these moths are seen, or have been seen, flying, there will probably be found on the stems of grasses and other plants some of the curious objects shown on this page; these are the cocoons of the Five-Spot Burnet Moth. From four of those shown in the photograph, it will be observed, the moths have emerged, leaving the empty, black chrysalis skins protruding from the tops of the cocoons. Sometimes these cocoons are very numerous, the grasses in some parts of the fields being more or less covered with them. The moths deposit their eggs amongst clover and grasses during June.

Towards the end of August a species of conspicuous yellow and black banded caterpillars will be frequently found feeding, more or less gregariously, amongst the stems and yellow flowers of the common ragwort, as they are seen doing in the illustration on page 259. These are the larvæ of the Cinnabar Moth (*Hipocrita jacobeæ*), which is familiar in June about railway cuttings and hilly districts. The moth is, at first glance, not unlike the Burnets previously referred to, owing to the fact that its fore-wings are dark brown, and spotted and striped with red of a similar hue to that of the Burnets; the lower wings of these moths are also red like those of the Burnets. The wings, however, are larger, and the antennæ are hair-like when compared with those of the Burnet Moths. The Cinnabar Moth, too, is not at all an active insect during sunlight, usually flying during the evening, though sometimes it is seen fluttering amongst the grasses during the day. The larvæ, doubtless, present an instance of warning colours, black and yellow being colours particularly favoured for this purpose: stinging insects such as bees, wasps, and hornets represent

COCOONS OF THE FIVE-SPOT BURNET MOTH.

LARVÆ OF THE CINNABAR MOTH FEEDING ON RAGWORT.

well-known instances. Also, larvæ that produce warning colours often feed more or less gregariously, as by this means they present a greater display of their warning features to their enemies; hence these caterpillars feed boldly in the sunlight, and look quite conspicuous objects amongst the stems and flowers.

Turning from the pretty side of the insect life to the less agreeable, we may glance at the Cuckoo Spit — which I need scarcely say has nothing whatever to do with the cuckoo. This white, frothy mass, which is seen deposited about trees and herbage of all kinds, is purely the work of an insect larva, viz. that of the Frog-Hopper (*Aphrophora spumaria*). The Frog-Hopper itself appears at the end of July, and is a small insect about five-sixteenths of an inch in length, and is possessed of great jumping powers. In the corner of the illustration on this page I have shown the insect at twice its natural size, with its wing-covers partly opened; for these insects are good fliers as well as jumpers. The larva feeds in the mass of froth produced from the juices of the plant, its long beak being plunged into the plant tissues. During the larval stages the insect has no wings, although it resembles in shape the fully-developed insect. In the pupa stage the wings are rudimentary. Finally, it loses its green colour, and develops into a curious insect somewhat like a miniature frog in shape, but possessing pale-coloured, membranous wing-covers bearing large brown spots, and beneath these a pair of ordinary flying

"CUCKOO-SPIT."

At the top is shown the Frog-Hopper, which, in its early stage, produces the frothy substance. The insect is shown twice its natural size.

wings. Its hind-legs possess powerful muscles, by means of which it makes its extraordinary vanishing leaps just as one attempts to capture it. The insect is common everywhere. There is also a much more handsome species known as the Scarlet Hopper (*Cercopis sanguinolenta*) which is frequently seen in gardens. This insect has its wing-covers coloured scarlet and black, and is larger than the common Frog-Hopper.

THE STAG BEETLE.
The largest British Beetle.

On this page another conspicuous insect is shown that can scarcely be placed amongst beautiful insects. The Stag Beetle (*Lucanus cervus*) is familiar in the southern counties after midsummer. It is the largest of British beetles, and the male insect is a blundering, clumsy fellow. As he flies along country lanes, he often comes to grief, for no other reason, apparently, than that one has driven or cycled beneath him. He falls like a stone, and as he lies on his horny back, his legs strike out in all directions; but take care, if you attempt to pick him up, to avoid his large and strong mandibles, for he sometimes bites severely. The female beetle has not the large jaws of the male, but do not let this fact encourage anyone to trust her either, for, although her mandibles are not so large and awe-inspiring, yet they are sharper and meet more closely, and consequently her bite is worse than that of the male. The function of these large and strong mandibles is that of abrading the young branches of trees and other vegetable substances, as a means of reaching their juices. It is in its larval state, however, that this insect is most

injurious. The grub lives within the trunks of trees, feeding on the tissues of the wood, and takes at least three or four years to complete its development.

Having glanced at the largest of British land beetles, we may conclude by a brief consideration of the largest species of the British Water or Diving Beetles.

The photograph below shows a pair of these beetles (*Dytiscus marginalis*). To see some of the beetles in the living state is an easy matter. On the surface of a pond a number of objects may be seen floating like little corks; throw a stone into the water and instantly every one of them disappears. Wait for a while and remain quiet, however, and the objects will, one after another, come back to the surface again, simply because they are compelled to do so. They are Water or Diving Beetles such as those shown in the photograph, or nearly related species, and as they are air-breathers they must come to the surface as soon as their air supply is exhausted. So they float upwards and poke out of the water the tail ends of their bodies to breathe; not that the insects breathe through their tails, but in that position they can take in air under their horny wing-covers. The air is then in contact with a series of little holes called "spiracles" arranged along each side of their bodies, and it is through these holes that the beetles breathe. Indeed they breathe just as other insects do, for insects do not respire through their mouths; even on the body of a caterpillar a row of spiracles will be found on both sides of the body. Thus the beetles become, as it were, diving bells. Now, a little observation of this kind not only teaches how this insect breathes, but, if it be desired to make a capture, it will be obvious that, by waiting until the beetle nears the surface of the water, a sudden swoop with the water-net at that moment will most probably be successful, as the insect cannot return to the depths if its air supply is exhausted. The insects, however, are remarkably quick, and their capture is not easy; a better way to secure them is to drag in the water-weeds and search amongst them. Their wings are large, and as evening approaches the beetles climb the stems of water-plants to expand them. In this way they reach new ponds and seek their mates; sometimes, too, as daylight approaches they are in such a hurry to get back to their aquatic surroundings before their daylight enemies get abroad, that they not infrequently allow themselves to drop like stones upon the roofs of greenhouses and similar places, which from above they have doubtless mistaken, in the twilight, for a sheet of water.

JOHN J. WARD.

MALE AND FEMALE WATER OR DIVING BEETLES.
The male is on the left.

HOW TO KNOW THE TREES GROWING IN BRITAIN

With Notes, descriptive and photographic, for their Identification in all Seasons of the Year

By HENRY IRVING

THE WALNUT

THIS tree grows to a considerable size, and is both handsome and picturesque. It has marked dignity. From the time of the ancient Greeks, it has been distinguished by the epithet "kingly." Its fruit, also, has been ever greatly esteemed. With us the walnut is mainly a tree of the planted park or garden, though here and there it may be found ranking with the trees of the wayside as in the green lanes of North Devon in the neighbourhood of Porlock. This might have been more general but for the demands made upon its timber for the manufacture of gun-stocks in the time of the Napoleonic wars. It is a distinctive feature in any landscape where it occurs.

WALNUT TREE IN WINTER.

In *winter*, silhouetted against the sky, it is one of the cleanest of our trees, being entirely bare of everything save buds. Dividing into branches rather low down, it throws these out and up with a superb gesture. These branches again divide and subdivide with infinitude of graceful curvature.

In *spring* its leaves expand russet-tinted, and at the same time its green, handsome, pollen-bearing catkins grow out and elongate.

In *summer* its massed foliage, yellowish green, in

TRUNK AND BARK OF THE WALNUT.

multiplied subdivision, completely clothes the tree's framework, forming a symmetrical crown, rounded and dense, and affording a pleasant contrast amongst the greens of this season.

In *autumn* the round, green fruits become evident in small clusters of two or three at the tips of the twigs. Then the leaves slowly assume their yellow to brownish fading tints, the fruits at the same time browning to ripeness.

The *trunk* is strong and round, but usually is short, and divides low down. The *bark* is whitish grey, roughened often into distinctly lattice-shaped markings.

The *winter twigs* are smooth and shining, grey to brown in colour, cylindrical, and rather stout. A distinctive peculiarity of these is that the pith is not continuous, but consists of a series of thin plates dividing the otherwise hollow tube into a number of cells, or chambers, which can be exposed by splitting the twig lengthwise. These twigs externally bear some resemblance to those of the ash, but they can be at once recognised in that the *resting buds* of the walnut are arranged spirally and not in opposite pairs. The buds are thick and rounded, dark in colour, and protected almost entirely by two scales. They stand out on prominent bases. The *leaf-scars* are saddle-shaped, showing three groups of leaf-traces.

The *leaves* are not simple, as are those of all the trees previously considered, but compound. That is to say, each leaf consists of a number of simple leaflets. There are from two

AGED ROADSIDE WALNUT TREE IN NORTH DEVON.

WINTER TWIG OF THE WALNUT.

to four pairs of these leaflets arranged on opposite sides of a central stalk, which terminates in an added leaflet. The veining of the compound leaf so composed is the same in character as that of the simple leaves already considered—a midrib with branching pairs of side ribs. Here, however, the midrib of the walnut's compound leaf takes the character of a central stalk, which terminates at the apex of the uppermost single leaflet; whilst each separate side rib, branching from this central stalk, becomes the midrib of a separate leaflet, having itself numerous pairs of side ribs. A marked peculiarity of these side ribs in the leaflets of the walnut is that they do not terminate in the margin, but curve over, like a whip-lash, looping each into the next. The shape of each leaflet is oval, somewhat pointed, and without marginal indentations. The compound leaf of the ash is similar in nearly every respect to that of the walnut, but the leaflets of the ash are more sharply pointed, and their margins are distinctly and evenly serrated. Walnut leaves are strongly aromatic, especially when crushed.

LEAF-SCAR OF THE WALNUT (ENLARGED).

The *flowers* are separate, but grow on the same tree. They appear with the leaves. The pollen-bearing flowers are gathered into a stout, pendulous, green catkin, growing singly from a lateral bud on the previous year's shoot, unattended with foliage leaves. The terminal bud of the same shoot grows out at the same time into a new shoot bearing foliage, and itself probably terminates with a small cluster of from two to five of the fruit-producing flowers. These are globular, green, bud-like, and erect, each with a pair of purplish plumes, the receptive stigmas waiting for the wind-blown pollen from the pendulous catkins.

LEAF OF THE WALNUT DIVIDED INTO NINE LEAFLETS.

The *fruits* also grow in a cluster, usually two or three, at the tips of the current year's shoots. They are oval in shape, smooth, and in colour green changing to brown. The walnut fruit is not a nut but a stone fruit, the outer fleshy layer of which has not acquired edible qualities, as in the case of the plum or the cherry. When ripe this outer layer splits open irregularly, exposing the "stone" with its hard, bivalve shell protecting the curiously wrinkled twin kernels, held in so high esteem as sweet and nutritious, though by us scarcely regarded as of such superlative worth as to justify the old name—"Juglans," the fruit of Jove.

HENRY IRVING.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.
Author of "Wee Tim'rous Beasties," etc.

THE MOLE

With Photographs by the Author

THE existing evidence with respect to the life-history of the Mole is not only conflicting but bewildering. Few wild animals have proved so attractive to the curious, few have so baffled curiosity, and in no case has observation been beset with greater difficulties. We can but conjecture as to the circumstances of his life-cycle. On rare occasions we may encounter him above ground—he has sometimes been observed swimming—a practice for which his paddle-hands and partially webbed hind feet should peculiarly fit him. But, if the only evidence of a Mole's existence were to be derived from such encounters, we should consider him an extremely rare animal, and it would be rash to draw conclusions as to his everyday below-ground habits and appearance from circumstances which, as far as we know, are almost as abnormal as those of the stranded fish.

A MOLE'S FORTRESS SITUATED AT THE ROOT OF A TREE.

The anatomy of the Mole has been minutely investigated, and it might be supposed that a conception of his living appearance, based on such investigations, would be approximately correct. It must be remembered, however, that the anatomy of the Mole is peculiarly aberrant. There are no easily observed forms of life to which we might refer for some standard of comparison, and the difficulty in reconstructing a Mole's characteristic attitudes from his bones and muscles is the difficulty experienced in reconstructing the Okapi. My photographs give, I think, a good idea of the set of a living Mole's limbs, of the texture of his fur, and of his appearance out of his element; but I claim no more for them than that.

The evidence we chiefly rely on in respect to the life-history of the Mole is derived from his earth-works, and these may conveniently be divided into his fortresses, his hillocks, and his runs. All three present interesting and, at present, only partially solved problems.

The fortress appears to have been first investigated by a Frenchman, Le Court. From his notes, which were adopted by Geoffroy Saint-Hilaire, is derived a text-book illustration purporting to represent a fortress interior, and the nest within it, which is probably familiar to many of my readers. The fortress is represented as containing two horizontal circular galleries, one about level with the top of the nest, and one

somewhat higher, which are connected by four or five perpendicular shafts. Runs proceed without at definite intervals from the lower gallery, and there is a single entrance to the nest itself from below.

In justice to this illustration it should be remembered that the original investigator hardly regarded it as the picture of any one fortress in particular, but rather as a type, to which fortresses in general more or less conformed. Generations of writers, however, have accepted it without any such reservation, and although many field-workers must have been sadly disillusioned when they applied to the text-book figure the test of practical experience, they seem, without exception, to have attributed their disillusionment either to personal ill-fortune or to the difficulties inherent in sectioning a honeycombed structure of crumbly material. It was left to Mr. Lionel Adams to approach the difficulty in a scientific manner, and his conclusions, based on sketch-plans of the interiors of about a hundred fortresses, were communicated to the Manchester Philosophical and Literary Society in 1902.

VERTICAL SECTION THROUGH AN EXCEPTIONALLY LARGE MOLE-FORTRESS, SHOWING FOUR NESTS *IN SITU*.

The fortress contained six nests in good order and the remains of a seventh.

So far from the galleries surrounding the nest in a Mole-fortress being designed on any definite principle, and serving as an ingenious labyrinth to baffle the Mole's enemies, Mr. Adams holds, as the result of four years' investigations, that no two fortresses are alike, and that the galleries, which assume haphazard curves and tend in haphazard directions, "*are the natural, incidental, and inevitable outcome of the work of excavating the nest-cavity and piling up the superincumbent mound.*" One could hardly conceive a view more diametrically opposed to that previously held.

As to the haphazard direction of the galleries I am in entire agreement with Mr. Adams. The portion of a Mole-fortress above ground level (the top of the nest is usually about ground level) presents no definite plan, and requires no particular engineering skill on the part of the Mole. So far as a simple fortress with one nest in it is concerned, it may well happen that a single spiral gallery, incidental to the work of excavation, may suffice not only to remove the soil from the nest-cavity and raise a mound of proportions to the Mole's liking, but also to ensure a stable, well-ventilated, and water-proof structure. Where the fortress is complicated, however, and

contains not one, but two, three, and even six nests (as was the case in one vast mound, of which I give an illustration) the pressure of the superincumbent soil becomes a serious matter, and I am inclined to think that the Moles drive arched galleries above the nests, primarily to relieve this pressure, and, secondarily, to secure some kind of drainage away from the nests, and some kind of ventilation. The necessity for the latter will be quickly realised by anyone who keeps a Mole closely confined. It is the repair and maintenance of these galleries (I have found a gallery above the nest as polished as a main run), and possibly also the construction of fresh ones, which causes the external appearance of an established fortress to alter appreciably from time to time.

The reconstruction of a simple Mole-fortress, of which I give an illustration, was effected, so far as the above-ground portion was concerned, by means of drawings to scale, of a series of vertical sections at distances of one inch from each other, commencing on the west side of the mound. Horizontal sections were made at the same intervals for the portion below ground level, and both horizontal and vertical sections were scaled to fixed ordinates. The soil was in a suitable condition for cutting, and I think that the counterfeit may be regarded as approximating fairly closely to the actuality. It must, of course, be remembered that the reconstruction is, in a sense, negative, space being represented by matter and matter by space.

RECONSTRUCTION OF THE INTERIOR OF A MOLE'S FORTRESS.

The nest-cavity is represented by the rough sphere, the tunnels by the surrounding ramification.

The long diameter N to S of this mound at ground level was about a yard, the short diameter about twenty-seven inches, the height about ten inches. These may be considered as fair average dimensions of fortresses in marshy ground. There were eleven exits into the surrounding soil, eight of which can be seen in the picture. These exits were at depths ranging from four inches to eight inches below ground level. There were three entrances to the nest, one at six inches below ground level, the other two at five. The top of the nest-cavity was about two inches above ground level, and the bottom about six inches below. A blind gallery described a winding curve upwards from the nest-cavity. Another blind gallery, with a forked termination, lay

EXCAVATION OF A SIMPLE MOLE-FORTRESS.

Showing the nest-cavity, with nest *in situ*, and an opening in the tunnel used for removing the soil from the nest-cavity.

nearly over the nest-cavity and reached within two inches of the uppermost point of the mound.

The dimensions of the largest mound

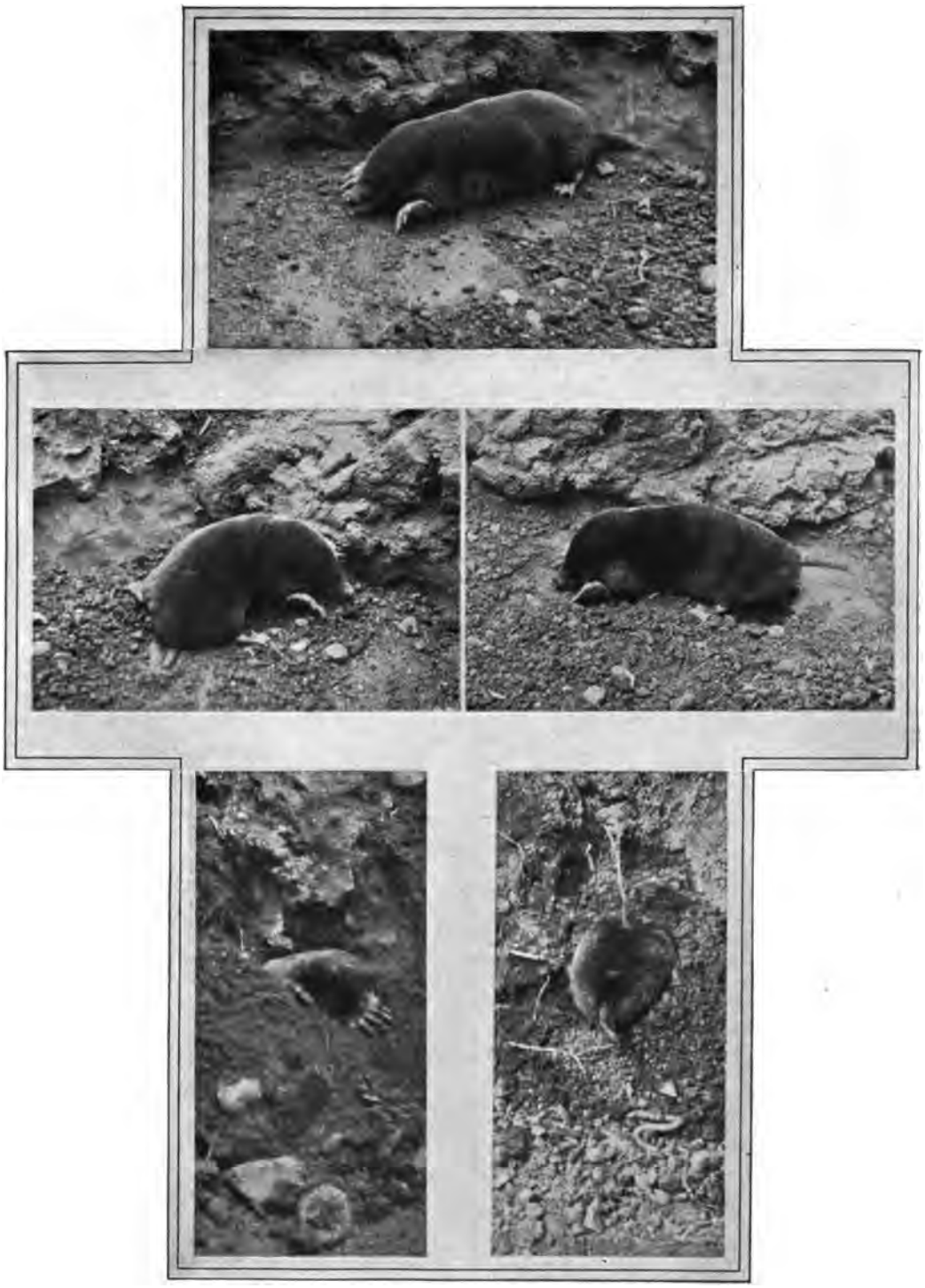
MOLE DEVOURING A WORM.

I have yet encountered (I excavated it in April, 1907, and give an illustration on p. 266 of one stage of the work) were—long diameter N to S, six feet, short diameter W to E, five feet, height sixteen inches. This mound was pear-shaped, the broadest portion lying towards the south, and the circumference, measured at ground level, was no less than nineteen feet. I have little doubt that it served as winter quarters for a number of Moles—who I suspect are normally reduced by cold to a torpid condition—and I was interested to find last autumn that it had been partially reconstructed. I am at a loss, however, to account for the attractiveness of the site. With regard to the probability of Moles hibernating, it seems hazardous to deny to the Mole any share in that provision of Nature which is obvious in the case of the Hedgehog, and practically certain in the case of the Shrew Mice. Hibernation is a question of food supply as well as of temperature, and, although it is hardly conceivable that the supply of subterranean food within reach of a Mole's burrowing power should ever fail him completely, it must be remembered that the harder the ground is, the deeper the Mole will have to go, the more arduous will be his labour, and the more insatiable his appetite. The depth to which a Mole can burrow is, in many districts, limited by the water level.

One often finds a fresh burst of hillocks after a snowstorm, and such hillocks present a curious, starred appearance, owing to the sudden fracture and upheaval of the snow-crust. Their presence can hardly be regarded as serious evidence against the possibility of Moles hibernating. When the ground is covered with snow the loss of heat by radiation is, to a great extent, prevented, and, other things being equal, a snow-covered meadow in hard weather will provide the Mole with more easily won sustenance than a green one.

It is necessary to draw a distinction between the winter fortress and the breeding fortress of the Mole. I have never found more than one nest in the latter. It is often situated in the im-

A MOLE'S SURFACE RUN LEADING TO WATER.
The run commences at the bottom right-hand corner and turns sharply to the left half-way up the picture.



SOME CHARACTERISTIC ATTITUDES OF THE MOLE.
In the lower left-hand picture the Mole is seen emerging, and in the lower right-hand picture burrowing.

mediate neighbourhood of one or more winter fortresses, and may sometimes be distinguished by its relatively small size and freshly worked appearance. The distinction, however, is not invariable. I have taken young Moles from a fortress whose well-turfed surface presented quite a venerable appearance. In such the most frequent nest to be encountered is that of the Humble Bee. I have never found, either in the case of the winter fortress or in that of the breeding fortress, the slightest attempt at concealment of the site, and, with the reservation that my experience has been confined to fortresses situated in soft, swampy ground, I have no hesitation in saying that it is the rule to find Mole fortresses stark in the middle of the meadow, and the exception to find them cloaked in the hedgerow.

THE MOLE.
The normal radiation of the fur round the minute, dull-coloured eye can be seen in the photograph.

It has been asserted that the female alone is responsible for the breeding fortress, and also for the short, winding runs, while the male makes the winter fortress and the long, straight runs. I think, however, that some better evidence than trapping is required to justify these theories, and, until such evidence is forthcoming, the question of their truth should be left open. I have not been able to satisfy myself that either the breeding fortress or the breeding nest present any marked peculiarities of structure. Moles' nests are composed of the most easily gathered material. Should the ground above be carpeted with leaves, the nest will consist largely of leaves; should there be little but grass, the nest will be grass. A grass nest looks as if the animal had simply rolled the material round himself; and a fair imitation of one can be made by holding the two ends of a bundle of coarse grass and circling the hands round each other.

Some interesting information as to the method of the Mole in collecting leaves was recently published in the "Country Side." The author, who has adopted the *nom-de-guerre* of "Gamekeeper," writes:—"It came along one of its shallow runs, through the top of which it would thrust its nose at a likely spot and feel around till it came in contact with a dry leaf—this it would at once detect and seize with its teeth, carting it off, I presume, to the nest-site. Each interval between the seizing of the leaf and the energetic little beast's reappearance was about ten seconds . . . . it never came out further than to show its head and neck."

I have most often found litters of young Moles in May. The young are usually four in number, and the most remarkable feature about them is the extremely large size to which they attain before there is a vestige of fur on their bodies.

With this large size (I have frequently taken young fur-less Moles between three and four inches long) is associated a corresponding muscular development; but the absence of any serviceable teeth shows that the infants are as yet entirely dependent on their mother, and it would seem as if Nature had made careful provision that they should not leave the shelter of the nest before their strength was sufficiently developed to cope with the strenuous life before them.

The very early stages of young Moles present extremely interesting features owing to the light which they seem to throw on the evolution of Moles generally, and on the probable extent of a Mole's powers of sight and hearing. In the earliest stage which I have been able to examine, the eye is decidedly prominent. It stands out from the side of the head like a black pin-head, and measures approximately ·3 mm. in diameter, the length of the head from crown to nose-tip being, at this time, about 5 mm. At a later stage, when the head measures 10 mm. and the eye ·5 mm., the latter has a sunken appearance, and is covered with a membrane which persists until the young Mole is ready to leave the nest. When this occurs the eyes "open" in the usual manner.

In the dead adult Mole the eye is so completely hidden by the fur that the inexperienced may have some difficulty in finding it. In a living Mole, however, who is in good fettle and vigorous (this is seldom the case with Moles caught on the surface), the fur stars round the eye to a breadth of about 5 mm., and leaves the eye clearly exposed as a dull-black pin-head at the bottom of a greyish cone. The Mole evidently possesses the power of radiating the fur round his eyes at will, and the presence of stiff, outstanding bristles in their immediate neighbourhood enables him to determine when such radiation may safely take place. In a healthy Mole above ground the fur is *always* radiated.

The external ear seems to pass through similar phases of degeneration. In the quite early stage there are some signs of a conch, but this soon contracts to a small fleshy protuberance with a slit across it, and, in the adult Mole, the ear-opening can hardly be detected without shaving the fur.

It is further noticeable that the remarkable outward twist of a Mole's hands is a comparatively late development in the young Mole.

A MOLE'S ZIGZAG SURFACE RUN.

All these facts point to the likelihood of the Mole's evident adaptation to a subterranean life having been gradually acquired, and, although it would be risky to base any conclusions as to his powers of sight and hearing on merely external features, the size and position of his eye must, I think, preclude any extended range of vision. The question of his hearing is more difficult, as it can be proved by experiment that the Mole is extremely sensitive to sound-vibrations. It may be found in future investigations

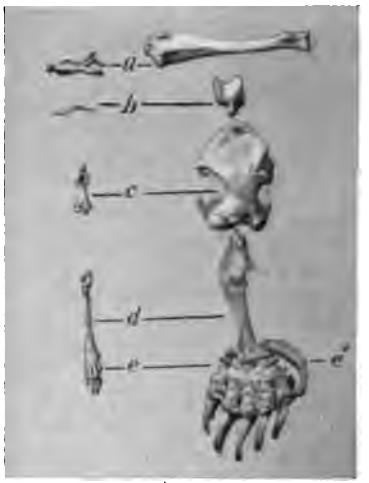
that the internal structure of the ear is so specialised as to compensate for the absence of a conch.

The hillocks and surface runs, which appear in profusion wherever Moles establish themselves, are probably familiar to many who have never had the opportunity of seeing either a Mole-fortress or a live Mole. There are several problems in connection with them which do not appear, as yet, to have been solved. Surface runs will sometimes proceed for several yards without any signs of a hillock, and with only the arching of the soil, slightly broken here and there by pressure from below, to mark their direction. It is in such runs as these, especially those which lead towards water, or to the shelter of some thicket, that it is easiest to trap the Mole. At other times their course is indicated by a succession of hillocks whose combined bulk is out of all proportion to the disturbance of the earth which mere tunnelling would entail.

THE FORE-LIMB OF THE MOLE.

a, Scapula. *c*, Radius.
b, Humerus. *d*, Ulna.
e, Sesamoid.

It must be remembered in this connection that a Mole works like a cylindrical boring tool, and that he employs his hands (as may be seen from their imprints in stiff soil) to compress the earth, which he dislodges with his nose and fingers, against the sides of his tunnel. His progress, a succession of left and right twists and thrusts (sometimes he screws completely round so that he is working on his back), may be compared to the act of boring a crowbar into soft soil. Once he has got his head and shoulders into the ground he quickly disappears from sight without leaving much *débris* behind him. Sooner or later, however, his characteristic hillocks commence to appear. Mr. Adams holds, and I agree with him, that in raising a hillock the Mole is pushing up soil from below with his nose. One is sometimes fortunate enough to see this rose-tipped member while the hillock is in the making; more often, however, one can only see the effect of it. The hillock rises in jerks, often with considerable pauses between them, the earth splitting up the centre and cascading down the sides.

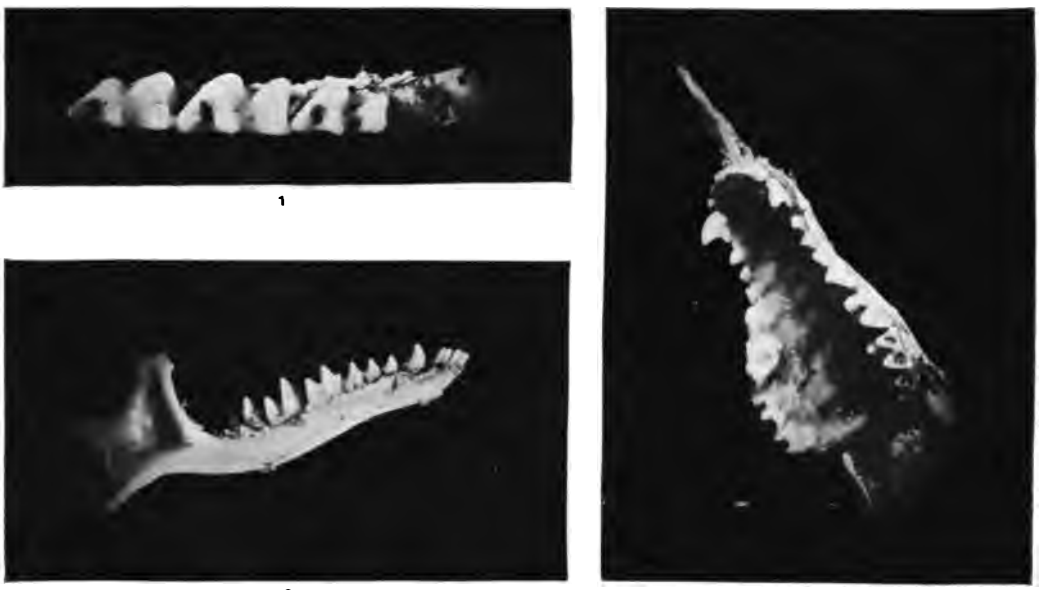


THE SHOULDER AND ARM BONES OF THE MOLE, WITH THE CORRESPONDING BONES OF THE SHREW MOUSE ON THE LEFT FOR COMPARISON.

a, Shoulder blade (scapula). *d*, Lower arm bones (Radius and Ulna).
b, Collar bone (clavicle).
c, Upper arm bone (Humerus). *e*, Hand.
e', Sesamoid.

VERTICAL SECTION THROUGH ONE SIDE OF A MOLE'S LOWER JAW, SHOWING THE STRUCTURE OF THE TEETH AND THEIR ROOTS *IN SITU*.

On brushing aside the earth, which is usually finely pulverised, one sometimes finds a deep, perpendicular down-shaft, sometimes an opening in a horizontal run. I incline to the opinion that the hillocks mean that the Mole is feeding, and that they are composed of the earth which he scratches out at random in the pursuit of worm or insect. If my assumption be correct, we must imagine the Mole to leave his nest when hungry, and to speed along his main runs until he locates by scent some worm or insect. This he scratches out and devours. When his appetite is satisfied he proceeds to tidy up. Should his captures have been effected deep below the surface, he drives a clearance-shaft the shortest way upwards; should he have been feeding from a surface run he rears a hillock immediately above it, or slightly to one side of it. In the latter case one can sometimes catch him by driving the heel down and so cutting off his retreat. Some dogs are extraordinarily clever in detecting the movements of a Mole working close to the surface. A terrier dog of my acquaintance, the best Mole-catcher I have known, had drilled himself to accomplish his captures in three motions. First he would point, with a back glance from the corner of his eye, which plainly asked anyone accompanying him to keep quiet; then he would slowly rear on his hind legs; then he would fling forward, and, I think, pin the Mole with his fore feet. Another second and the poor little "gentleman in black" was flung high in the air. Should this dog happen to miss (he seldom *did* miss), he wasted no time in futile scratching. He knew better.



DENTITION OF THE MOLE.
1. Grinding surface of worn lower molars. 2. Right lower jaw.
3. Upper jaws. The protuberance at the top is the bony cartilage which supports the nose.

The strength of a Mole, in proportion to his size, is prodigious, and the arrangement of the muscles of his shoulder and fore-arm is such that he can exert his maximum strength by the sweep of his hands from a point close to the end of his nose to one well behind his shoulder. Several experiments, made with a view to determining his strength, have been recorded. I have a note of a curious one of my own which had the demerit of being purely accidental. A cage in which I once enclosed a lively Mole had as its only possible exit a half-plate printing frame. The Mole escaped by forcing his way between the rebate and back of this frame. To do this he had to overcome

the pressure of the spring which held one side of the back in position, and the force necessary was equivalent to the weight of 7½ lbs., about thirty times that of the Mole himself. The strength of the Mole can best be realised by holding a full-grown one in one's hand and allowing it to commence boring operations between one's fingers. I have known a young Mole to accompany such boring with a curious clicking noise. I am inclined to think that the noise was mechanical rather than vocal, though I would not go so far as to suggest a ratchet motion! The voice of the young Mole is a high-pitched squeak, and that of the adult a squeal which is almost pig-like.

I have, on more than one occasion, resorted to my sense of touch to determine the character of the boring by which a Mole drives a surface run in loose soil. I have accomplished this by noting the direction in which a Mole is travelling, and pushing a finger deep into the ground to bar his progress. The first sensation experienced is the screwing of the Mole's nose. Then one feels the nose slip forward and the claws of one hand brought to bear with extraordinary force. Finally one feels the Mole's teeth. It is possible, of course, that the Mole may mistake the finger for a prodigious worm, but, from the nature of the cut which his teeth inflict under these circumstances, I think that progress rather than feeding is in his mind.

Every part of the Mole is modified to suit the conditions under which he lives, but his teeth, the bones of his shoulder and arm, and his hair, present features of peculiar interest. A Mole's hair is almost identical with that of a Shrew Mouse, and we will consider it in the following article, noting now only the peculiar difference of coloration which it presents, accordingly as it is stroked from head to tail or from tail to head. The latter gives the rich characteristic black velvet, the former a soft sheen of indigo.

The shoulder and arm bones of the Mole are of an extraordinary character, and the bone of the upper arm (*humerus*) is one of the most aberrant bones known. In the case of most animals (including ourselves) the *humerus* is typically "bone-shaped." In the Mole, however, the *humerus* presents a form of which I think my photographs will give a better idea than any attempt at a description. The collar bone (*clavicle*) is almost equally peculiar, and the shoulder-blade (*scapula*) presents an exceptionally long area for the attachment of the great shoulder muscles. The massive character and interlocking of the two bones of the fore-arm, and the modification of the hand by the sickle-bone (*sesamoid*), which makes an effective spade or fork of it, according to the opening or closing of the fingers, can be seen in the illustration. Remembering that the massive character of these bones is well matched by the massive character of the muscles attached to them, the reader will be able to realise the immense strength which the Mole can exert with his fore-limbs.

The Mole possesses forty-four teeth, and the points in which the molars differ from those forms which we have already considered can be easily seen in the photographs. The back teeth of insectivorous animals are pre-eminently well adapted for dealing with hard, slippery, and wriggling material. A nip with two opposing rows of them will pin any creature which lies within their sphere of action in twelve different points; a bite will cut it into twelve different pieces. Thus a worm or insect is comminuted rather than ground by the Mole's teeth, and once the Mole has a grip of him his fate is sealed. In eating an earth-worm the Mole's evident intention is to trap a considerable portion of it lengthways in his mouth, and not across it. He bites, like a Shrew Mouse, first with one side of his jaws and then with the other. He commences by holding the worm between the in-turned sides of his hands, and draws one end of it up between them with his teeth, a process which no doubt gets rid of much of the slime-coating. The part of the worm between his teeth and hands is stretched taut, while the part beyond his hands wriggles miserably. I have sometimes seen a Mole make a series of little nips along a large worm before he attempted to eat it. No doubt this action serves in some way to cripple the worm, but the crippling is not very obvious.

DOUGLAS ENGLISH.

THE ROCK GARDEN, HARTLEY GRANGE. *Photograph by F. Mason Good, Winchfield.*

ROCK, WALL AND WATER GARDENS

By H. H. THOMAS

THOUGHTS of one invariably conjure up pictures of the others; the rock garden is incomplete without its pond, pool or rivulet, and the water garden, although not wanting in intrinsic charm, gains in picturesqueness if here and there its ripples wash bold, rock-studded shore. The rock garden is the most difficult of all gardens to make. Unless one works in the closest touch with Nature, and takes for model one or more of her own exquisite examples, the natural will inevitably be subordinate to the artificial, and when the work is complete it may be found that instead of a rock garden one has made merely a rockery. I write slightingly of a rockery, and I think with good reason, since there is rarely an excuse for its existence; in other words a rock garden might well have been made instead. The making and planting of a rock garden might be included among the fine arts, but the building of a rockery is a work that demands no skill, no taste, and little knowledge of the ways of plants. The rockery is a jumble of stones or clinkers or bricks and soil and plants; there is no good reason for the presence

of the latter, since they would grow just as well anywhere else—in the garden border, for instance, they would probably thrive far better. The rock garden proper is a home for Alpine plants, and it cannot be said with truth that they would be as happy elsewhere. It is a home for mountain flowers, for fragile blossoms, must bestow upon them such care as Nature herself expends on her own wild hill-top blossoms.

One must have spent lone hours among the hills and dales, the rocks and rills, in winter and in summer, ere one can know the ways of rock garden plants. Their likes are so subtle and their dis-

Photograph by F. Mason Good, Winchfield.

ON THE TERRACE, HOME PLACE, LIMPSFIELD, SURREY.

for those that love sun and others that love shade—a garden in the best conception of the word, a place where the likes and dislikes of each plant may be studied and its needs fulfilled. In the whole realm of garden flowers there are no greater sticklers for aspect and position than these exquisite Alpine blooms from the rocks, the margins of mountain rills, from snow-bound peaks, and to succeed in growing them is perhaps the highest expression of the gardener's art. One must know not only how and where they grow, but the kind of soil in which they grow; beyond and above all one likes so pronounced as to appear inexplicable, until one has solved the secret of their wayward lives. One must grow them, and by tender, constant care, by veiled experiment, by the subtle practise of one's deepest knowledge, endeavour to find the key to their cultivation. And here it is that actual experience tells. Your neighbour may grow some lovely Alpine flower to perfection, and give such explicit details of management as almost to embarrass you; yet, carrying out his instructions to the letter, you fail. It seems as though some of these tiny plants delighted to baffle the would-be grower, for they

insist that each shall find for himself, by experience, just how and where they delight to grow. And shall one blame them? The more exacting they are the greater is our delight when the secret is solved, and as a consequence the more tender our care of them.

Yet thus it is that for every rock garden one sees there are hundreds of rockeries—where scarcely the lowliest and least fastidious of mountain flowers will deign to grow.

In planting the rock garden it is best to turn for lessons to Nature's vast wild garden, for their variety is limitless, their capacity for teaching is inexhaustible. Here, the more one learns the more one finds there is still to learn. One must first appreciate the glamour of the rock garden, for it has an idealistic as well as a practical aspect, and even to the gardener perhaps the one is as important as the other. The charm of the rock garden depends upon its approximation to Nature's planting of the mountain chains, the Alpine peaks, the rugged waterways, the lonely, wooded heights. See there how Nature sows and plants and tends her tiniest flowers, and Time, the hoary gardener, throws a halo over all. There, and there only, is it possible to learn, and all unconsciously, how the spirit of the leaves and flowers pervades the grandest rock garden of all. Take a lesson from the heather-covered slopes —carpets of purple bloom when summer wanes, from the huge moss and lichen-crested boulders that appear to have stopped suddenly in a headlong course down the mountain side, from the regular succession of rocks watering with marvellous precision the tiny plants that cluster round them; aye, and more than all these things, let the poetry of the landscape make its appeal to you. For there is poetry even in the wildest of Nature's wilds, in the play of light and shadow from hill-top to valley, in the music of the mountain streams, in the gaunt, grey rocks, the sombre pines, and above all in the wondrous variety of her leaves and flowers.

At the moment, perhaps, one fails to realise that such an appeal can help one as a gardener, but in the fulness of time that realisation will come. Its practical value may never come home to you; you may exercise it unconsciously, but the ineffaceable memory from which inspiration springs must have an influence on your work. As the rock garden grows under your care it will be more or less natural, according to the depth and the poetry of the inspiration derived from those lone days and hours among the wilds of Nature's own rock garden of the hills. No true gardener, and above all no true rock gardener, can stand unmoved among his favourite plants as he sees them growing in full beauty and perfect association, amid the sublime grandeur of their Alpine home. On peaks unclimbable, clinging as if for very life on giddy precipice, yet more than safe, painting the ground with great patches of brilliant colour that rivals the cloudless sky in its depth of tone, springing from mossy bed on the shady side of some massive boulder, or nestling cosily in the shelter of mountain scrub, they thrive and bloom as though the very world were one of blossom, and all must play their part. And when the glory of sunset spreads and the snow is stained with the Alpen-glow, an added glamour touches them, a beauty that is scarcely theirs possesses them, and the subtle charm of the mountain flowers comes home to one. When working in the artificial rock garden one lives again those days among the Alpine flowers in Alpine lands; the memory of that enchanting time fills one with a deep longing, and a sense of real delight.

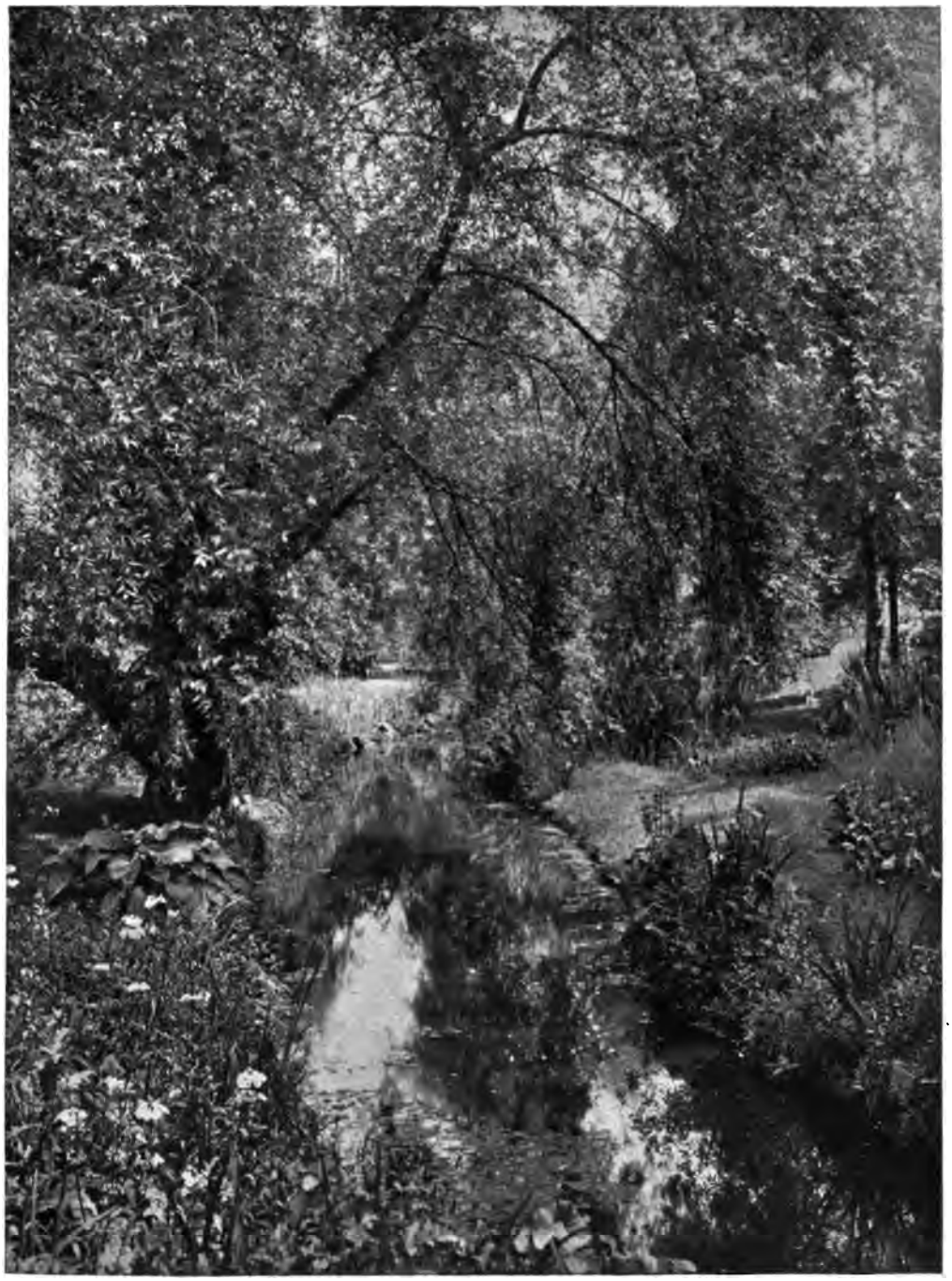
But what of rock garden plants? Ah! bewildering variety, incomparable beauty! They come from Scotland's misty moors, from Wales' dew-laden heights, from the sublime fastnesses of the Himalaya, from the Alpine lands of Europe, and far continents. Thus who shall tell how and what they are? I should not care to try. But some there are that must be named, since if one would make a rock garden only the most accommodating must be chosen at first. The Alpine Pinks, neat little tufts that are ever-grey rather than evergreen, are indispensable in early summer time; flowers of white or rose or pink bedeck the leaves, hiding the rock surfaces on which they love to grow. Then Bell-

flowers, chiefly in shades of blue, Alpine Primroses, preferring shade to sunshine, Silenes, Rockfoils or Saxifrages in endless variety, Rock Cresses and Candytuft, Snowflakes and Snowdrops, Windflowers or Anemones, Crocuses, Squills, Irises and Alpine Asters, are some that are least inclined to protest at irregular treatment. Fortunately it does not follow that the flowers most difficult to grow are those most beautiful; the least exacting make a rock garden of captivating charm. Of plants that delight to spread over sun-scorched stony banks, and hang a fringe of flower and foliage across unshadowed rocks, are the Madwort or Yellow Alyssum, Rock Rose and Rock Cress, Cistus, Spanish and Moonlight Broom, Scotch Heather and Irish Heath, some of the Rockfoils and Alpine Pinks, while shady nooks and crannies rely for their blossom largely on Alpine Primroses and Orchids, Wood Lilies, Wood Anemones, the Pyrenean Ramondia, Ferns in great variety, King Cups and Alpine Buttercups, and the Balearic Sandwort, that spreads a veil of green over barren rocks, and in summer hides both beneath countless tiny blossoms of purest white. When such as these are in bloom the rock garden is in its fullest beauty, its most enchanting mood, and gives the greatest joy to the majority of flower lovers. But the rock garden has also another phase of beauty that appeals no less successfully, though less ostentatiously, to those who understand its ways. For there comes a time when the brilliant masses of blossom, surpassingly beautiful though they may be, fail to satisfy the longings of the enthusiast. He turns for perfect enjoyment to individual plants, to those that give less prodigally of their bloom, and blossom only when experience has taught exactly how they should be grown.

Wall gardening may be described as at once one of the oldest and one of the newest ways of growing flowers. Are there not wall gardens sown by Nature herself centuries ago, walls whose stones are hidden beneath moss and lichen, whose every chink and crack is filled with Fern or other wilding? Yes, Nature's wall gardens are beautifully old, yet it is only within recent years that growing flowers in walls has become one of the fashionable ways of gardening. Now, in many gardens one sees specially made "dry" walls, built against banks of soil, without cement and without mortar, and, in due time, draped with masses of fairest flowers. Spaces are left between the stones, seeds or tiny plants are planted in the chinks, and soon their roots search deep in the soil behind.

To make a real wall garden one must begin early, for it is only beautiful when it has grown old. This is true of all gardens, but it is especially true of the wall garden. The greatest charm clings to the wall gardens that are old—old only in flight of years—those draped with lovely carelessness by ivy masses, whose crumbling walls are pierced by Ferns and topped by stunted Wallflowers, by casual bird-sown rowan or bramble, by beautiful wind-sown weeds. The artificial wall garden can scarcely ever hope to possess that *abandon*, that charm of perfect naturalness by which the wild wall gardens are distinguished. Still, if the seeds and plants are left to grow just how and where they please, passing years serve but to increase the beauty of the garden in the wall. Planted at the top of the wall where there is good depth of soil, there should be masses of purple and white Arabis, of evergreen Candytuft, throwing a light drapery of leaf and blossom across the rocky face and in the chinks and crevices, Wallflowers, Rockfoils, particularly the queen of all Saxifrages, the Pyramidal Rockfoil, Ferns self-sown, Snapdragons, Alpine Pink and Catchfly, patches of Heather, and the Ramondia that plants its broad leaves flat against the face of the wall and crowns these with blue and yellow blossoms. The wall of flowers is essentially a garden where the fittest are allowed to survive, and the tending is left to Nature.

Water gardens vary greatly in size, in aspect and in situation, but these things matter little if a sense of peace is all-pervading. A sense of repose should be inseparably associated with the water garden, so that at high noon in full summer time one may turn from gaudy flower-filled beds and borders for restful thoughts and subtle daylight dreams, that, for the moment, throw a veil over the world of



Photograph by F. Mason Good, Winchfield.

THE WATER GARDEN, MILTON COURT, DORKING.

hurry and bustle and strife, leaving one alone with that most refreshing of all Nature's sights and sounds—running, rippling water. Whether large or small, the surface should be flecked with floating Nymphaeas, in crimson, pink and white, with the wild yellow Nuphar, the flowering Rush, Bog Bean and Crowfoot, that make such perfect water gardens of roadside ponds and meadow pools. Here and there the cool white spathes and glossy leaves of the African Swamp Lily, Arum or Calla, give picturesqueness to the water surface, while the muddy edges of the shore are a mass of flower-fringed beauty. Here, gathered from among our own wild blooms and those of exotic lands, one should find the Yellow Flag, the graceful blue of the Siberian Iris, purple Loosestrife and rosy Willow-herb, the tall Yellow Lysimachia (of Creeping Jenny family), the common Toadflax and grey-leaved Potentil that spangle the banks of English rivers, giant grasses with graceful plumes. Close by, with their roots in drier ground, are planted Foxgloves, Pampas Grass, Spiraea or Meadow Sweet in red and cream and white, Brambles for flower and fruit, Japanese Roses, that bear large single blooms in early summer, and brilliant fruits when the blackberries ripen. These and other wild and stately plants should be disposed about the water garden, blending the latter harmoniously with the garden landscape and half concealing it. The water garden loses half its charm if it is seen from a distance. The glamour of the garden lies in the hidden, unsuspected beauties that show at every turn.

H. H. THOMAS.

Photograph by F. Mason Good, Winchfield.

THE ROCK GARDEN, SHENFIELD MANOR, NEAR BASINGSTOKE.

HOW TO KNOW THE WILD FLOWERS

By the REV. H. PUREFOY FITZGERALD, F.L.S.
With Photographs by HENRY IRVING

THE MEADOW FLOWERS

THE BUTTERCUPS

FIRST and foremost among the meadow flowers must be placed the Buttercups, and of those there are four different kinds, which can be easily distinguished from each other. The Bulbous Buttercup (*Ranunculus bulbosus*) is so called because the stem is usually thickened at the base into a sort of bulb; the flower stalks are furrowed and hairy, while the green sepals at the back of the yellow petals bend backwards towards the stalk when the flower expands. The Hairy Buttercup (*Ranunculus hirsutus*) also has the sepals of the expanded flower bent back, but the roots are fibres, and there is no trace of a bulbous thickening.

The Creeping Buttercup (*Ranunculus repens*), as the name implies, sends out runners in the same way as the Strawberry does, from among the lower leaves, which take root very rapidly and form fresh plants. Neither in this species nor in the Common Buttercup (*Ranunculus acris*) do the sepals bend back towards the flower stalk, but the creeping habit of the former will readily distinguish it from the latter.

The Common Buttercup is generally one of the tallest of the race, sometimes

THE CREEPING BUTTERCUP.

reaching a height of three feet; it begins to flower early in the summer and continues till late in the autumn. Each petal will be found to have a small yellow scale at the base, and the leaves are much cut

GERMANDER SPEEDWELL.

into segments, but the general form of the leaf is a rounded one, and the flowering stems are quite smooth, not furrowed as in the Creeping Buttercup. This plant is the Crowfoot that is so hated by dairy farmers; its juice is very acrid and is said to produce blisters, which may account for the cattle disliking it so much. It is found in very large numbers growing in pastures, and it is very difficult to eradicate. The Buttercups are visited by a great many different kinds of insects, which, attracted by the bright, golden blossoms, come to search for the honey secreted at the base of the petals; the pollen from the ripe anthers dust their abdomens, and in this manner it is conveyed from flower to flower. If a bud of the Common Buttercup be examined, it will be seen that insect visitors are kept from intruding and stealing the honey before the stamens are ripe by a fringe of hairs on the calyx. In wet weather the pollen is protected from the rain by the closing of the blossom and the curling of the stem; this latter making the flower hang with its head downwards.

BUGLE

A plant which is often to be found in pastures, but which grows also in moist woods and hedgerows, is the Bugle (*Ajuga reptans*). The two-lipped corolla will at once place it among the *Labiatæ*, in the same family as the Dead-Nettles, Wood-Sage and Ground Ivy; the upper lip, however, is very small, but the flower is more or less protected from the wet by being placed under the leafy bract of the flower just above it. The whole plant grows from three to twelve inches high, according to its position; it is almost free from hairs; the leaves are quite simple and arranged in pairs, as is the case with all the members of this big family. The rootstock creeps along, sending forth here and there an erect flowering stem; the flowers are borne in clusters round the stem (*i.e.*, in a whorl), in the axils of the leaves—the general colour is blue, but sometimes they may be found pink or white. The plant is in blossom from early in April to the end of June, and thrives best in damp spots. The name Bugle is said to come from a Latin word referring to a small glass pipe, which was used in feminine head-gear in the Middle Ages, and which the blossoms of this plant more or less resemble.

SPEEDWELL

Several sorts of Speedwell, or Bird's Eye, will be found growing by the wayside, in pastures, and in all kinds of waste

BUGLE.

CUCKOO FLOWER (LADY'S SMOCK).

places; the one shown in the photograph is the Germander Speedwell (*Veronica Chamædrys*), which flowers during May and June, and possibly for a little longer. These plants will be readily recognised by the bright blue flowers which tumble off under almost any pretext. The stamens

THE COWSLIP.

of this genus are reduced in number to two (the majority of the family of *Scrophularineæ* have four), and project somewhat. They are visited largely by the yellow-banded Hover-flies, which hover over a flower and then dart off like lightning to another spot. Probably the stamens act as a support to the body of the fly as it hovers and sucks up the honey; the pollen will naturally cling to the abdomen, and be transferred to the stigma of another flower which sticks out in a straight position; any larger number of stamens would only be in the way. The name Veronica is of doubtful origin; possibly these plants were named after St. Veronica, a saint of the Romish Church. Bird's Eye comes from the bright blue colour, and Speedwell from the flighty disposition of the blossoms. Tournefort's Speedwell, a trailing plant with large blue flowers, is a common weed, but it is not really a native.

CUCKOO FLOWER

The Lady's Smock, or Cuckoo Flower (*Cardamine pratensis*), as the old herbalist Gerarde says, "flowers in April and May, when the Cuckowe doth begin to sing her pleasant notes without stammering." The first name is due to the likeness borne by the pendulous white flowers to little smocks hung out to dry, as they used to be at this time of the year for bleaching purposes; Bittercress is also another name for it. The four white, or very often pale lilac, petals arranged in the form of a cross (as in all the *Cruciferæ*) and the pinnate leaves will be sufficient guides for recognition; in damp meadows and by the sides of streams it is found very abundantly during spring and early summer. The leaves, although a little bitter, may be used and eaten as cress; the fruit is a long pod.

THE COWSLIP

Throughout May and June many of the pastures will produce quantities of Cowslips (*Primula veris*). It is a very near relation of the Primrose, and the same pin-eyed and thrum-eyed arrangement of the stamens and pistil will be found. The calyx is of a pale green colour, the

corolla being deep yellow; the scent is very delicate; the flowers are borne on short stalks, all starting from the same point on the summit of the main flower-stem. We very frequently may find varieties of the Primrose which have several flowers on the same stem; the Oxlip and Polyanthus are examples, but in both of these the flowers are very much larger than those of the Cowslip. In the eastern counties the common name for the plant is Paigle; the word is spelt in many different ways, and its derivation and meaning are quite obscure. Another name for it is Herb Peter, from the resemblance of the head of flowers to a bunch of keys, the badge of St. Peter. In olden times it was used as a cure for paralysis, and was named Palsy-wort (*Herba paralyseos*). Cowslip wine is still made, the large secretion of honey in the tube of the corolla imparting a very sweet taste to the decoction.

BLADDER CAMPION.

BLADDER CAMPION

The Bladder Campion (*Silene cucubalus*) is frequently to be found throughout the summer, but it cannot be called a very common plant. It owes its name to its peculiar, inflated calyx, which is more than half an inch long and lined with many veins; after flowering the bladder grows more globular in shape. The petals are five in number, each one being somewhat deeply cleft, and having a small scale at the base, as is common to the members of the Pink family (*Caryophyllaceæ*). If several of the flowers be examined it will be found that these are of three kinds, some where only the ten stamens are perfect, some where the pistils only are perfect, and others which have both sets of organs complete. The Bladder Campion will be found growing in meadows and on roadside wastes and also at the edges of cornfields; it is a near relation to the White Campion or Bachelor's Buttons (*Lychnis alba*), to the Red Lychnis (*Lychnis diurna*), and to the Ragged Robin (*Lychnis Floscuculi*).

DANDELION

The Dandelion (*Taraxacum officinale*) blooms continuously from February till well on into October. Like the Daisy, it is one of the Composite family, but all the small single flowers are strap-shaped; each one bears both stamens and stigmas, the fruit, when ripe, having a feathery pappus, so that any slight breeze is sufficient to blow it away and so to assist in the dispersal of the seed. All the leaves and flower

DANDELION.

DEVIL'S-BIT SCABIOUS.

stems spring up from the root ; the stems contain a pungent, milky juice, and those bearing the flower heads are hollow. As to the origin of the name Dandelion, or Lion's Tooth, there are various opinions, but the most probable one is that it was given from the jagged tooth-like lobes of the leaf, albeit these resemble rather the jaw than the tooth of a lion.

DEVIL'S-BIT SCABIOUS

Many pastures during August and September from a distance appear to be tinged with deep blue, and this will most likely be due to the Devil's-bit Scabious (*Scabiosa Succisa*), a plant which is very fond of open meadow-land. A close relation, *Scabiosa arvensis*, is to be seen frequently in the hedgerows and woods, with much larger heads of flowers, of a pale lilac colour. Like the Dandelion, it bears a head of small florets, although it is not included in the Composite family, because each floret appears to have a calyx to itself : this is the distinguishing mark between the Compositæ and the Teasel family. If one of the root-stocks be dug up, it will be seen—if the plant be a young one—to be somewhat after the shape of a carrot, but if it is over a year old it will be more woody, and terminate abruptly as if the end had been bitten off. The legend runs that the root was a cure for all diseases, and "the Devill, for the envie that he beareth to mankind, bit it off at the root, because else it would be good for many uses." The leaves are hairy and rough, and spring mostly from the rootstock ; a few small leaves, generally with one or two teeth, are to be found on the stems.

PINK CENTAURY

In July the Pink Centaury (*Centaurium umbellatum*) begins to put forth its showy flowers. This is one of the Gentian family, and delights in dry pastures and sandy places. The leaves growing on the stem are stalkless and arranged in pairs, those lower down forming a tuft ; each leaf has three distinct veins on the upper surface. A cluster of pink, or red, or sometimes white flowers is borne on the summit of each stem; the corolla (or combined petals) has a slender tube fitting on to the calyx, and has five spreading divisions, star-like in shape. There are five stamens, and the anthers twist spirally after the pollen has been shed. The plant varies very much in its way of growth, but generally it is about eight inches high ; the blooms close about three o'clock in the afternoon, and also when the sky is overcast or when there is much moisture in the atmosphere.

CENTAURY.

H. PUREFOY FITZGERALD.

BRITISH FRESH-WATER FISH AND THEIR HAUNTS

By WALTER M. GALLICHAN

THE TROUT

NO fish that is born in fresh water arouses so keen an interest as the Trout. It is the theme of poets, the subject of many learned treatises, and the fish most beloved by the craft of anglers. The very name of the Trout brings recollections and visions of delightful mountain burns, rushing down from the scented peat bogs, in little gorges fringed with heather and fern; of rippled lochs, shining beneath the crags, and of quiet meadow country, where the fields are bright with patches of the kingcup, and the river flows sedately by trim farms, and through the arches of ancient grey bridges.

For the Trout is a creature of many waters, haunting the deep weir-pools of the Thames, the unfathomed pools of the mountains, the stripling streams of the moors, and the gliding rivers of the lowlands. Its habits, too, are elusive and fascinating; they afford an unending subject of discussion among those who follow the gentle art of fly-fishing and live much by the waterside. No man has ever learned all that can be learned concerning the reproduction of Trout, the conditions that govern their rapid growth in certain rivers, their adaptation to the waters in which they are bred, their instinct for wandering and exploring, and their cunning in outwitting the enemies that prey upon them. Even the gold and scarlet markings of the scales of a Trout open a wide field of scientific investigation into the wonders of natural selection; for there is little doubt that the handsome burnished Trout of clear streams, with its bright spots and innumerable speckles, has been evolved from the silvery Trout of the sea, that near relative of the Salmon.

To know something of the life-history of the Brown Trout, we must watch the waters with the keen vision of the heron or the kingfisher, and track the little fry in the tributaries that serve as nurseries to the main stream. We must visit the tarns that are hidden among the hummocks of the uplands, gaze into the deep, green pools of the rivers, and observe the fish when they are feeding, pairing, and migrating in the autumn. The study of fishes is, in many respects, more difficult than that of quadrupeds and birds; for the waters often baffle us, and the fish are very cautious in concealing themselves.

Trout are alert and nervous, and ages of adventure in evading the pursuit of the otter, and the several species of aquatic birds that feed upon them—not to speak of the experience gained during the centuries of fly-fishing—have taught them that concealment is an essential of their existence. This is why the casual rambler by the banks of a Trout stream may spend hours without seeing a single fish. He may, indeed, reach the conclusion that there are no Trout in the river. But the fisherman, whose eye is quick for those dimples that mark the spot where a Trout is rising to flies on the surface, knows that there are as many good Trout in the stream as ever came out of it.

The first scene in the life of a Trout is enacted at that hour when he emerges from the egg or spawn globule, which has been deposited by the parent on a clean bed of gravel. The "redds" or spawning grounds are selected with great care,

and they are usually situated in the affluents of the main river. From the time that the ova are deposited until the young Trout are big enough to take care of themselves, the spawn and the immature fish are exposed to many risks of destruction. A heavy flood sometimes causes the washing of silt and mud on to the spawning beds, and the eggs are lost.

A NURSERY OF TROUT.

Then there are the depredations of fish and birds. Eels are voracious devourers of ova, and even Trout will eat the spawn of their own species. Various aquatic birds, and domestic swans, geese and ducks, if they have access to the stream, consume a quantity of the eggs.

The diminutive Trout that emerges from the ovum is called an alevin. These tiny fry swim in dense shoals, and are to be seen in the quiet eddies and bays of the river, while they often swarm in the runnels. Their rate of growth is usually rapid, and they disperse before they are a few months old, and haunt the feeding-places of the mature Trout. Their chief enemies now are the heron, kingfisher, and the gull—among birds; and among fish the larger Trout are often their worst foes. Most Trout of half a pound, and even of less weight, will seize and swallow their smaller neighbours. More serious still are the attacks of pike and chub, which often breed in the lower reaches of Trout rivers. The otter also takes his toll of Trout; but he is not so destructive as many anglers imagine, for he subsists principally upon eels, frogs, and black slugs.

As the Trout approach the yearling stage, they become adventurous, and love to explore the streams. They frequent the shallows as soon as the temperature of the water rises in spring; and at this season they rise most eagerly to the flies that float upon the surface. A diet of surface insects restores them to good condition after the process of spawning; they become brighter in the scales, and their flesh is firmer after a few weeks of liberal feeding upon flies. Water that contains ample food produces big Trout in a short time; while in streams or lakes where bottom and surface food is scarce, Trout are small and often attenuated. The fresh-water shrimp, water snails, and minnows are highly nourishing. Besides these, the river beds supply the larvæ of flies and beetles; and in flood time worms and land insects are washed into the rivers.

A Trout of five years old may weigh over three pounds, or it may weigh no more than three ounces. Everything depends upon the quantity and quality of the food supply. Yearling Trout, reared in hatcheries and stock ponds, and turned into waters abundantly provided with insect life, very quickly grow into goodly fish. Blagdon Lake, near Bristol, is a water that presents every natural advantage for the production of heavy Trout; and small Trout, introduced to this lake, have grown almost miraculously in a short period.

What a difference is presented by the unshapely, dwarfed Trout of a cold Welsh lake among the mountains, or one of the over-populated lochs of the Highlands of Scotland, and the handsome, well-fed Trout of Blagdon. In Llyn Howel, for example—a deep pool in a rocky basin of the Harlech Mountains—the Trout are veritable pigmies, with large heads and big, staring eyes. No doubt many of these starved fish are several years old. The Lake District offers similar instances of stunted Trout in elevated tarns, though the lakes in a lower altitude produce Trout of two pounds and upwards.

The rivers that favour the vigorous growth of Trout are usually those which water a fairly fertile region of pasture and cultivated land. A belt of trees by the stream, the presence of weed in the water, and reeds along the banks, tend to the increase of weight in Trout. Wherever a few trees and bushes clothe the bank of an upland brook, the Trout are larger than those that frequent the bare reaches. Every tree produces and harbours insects, which often fall upon the surface of the stream or fly close to the water, and provide food for the Trout that lurk in the shadow of the boughs.

A SOUTH-COUNTRY TROUT STREAM.

In such streams as the Chess and the Ivel, in Bucks, and the Test and Itchen, in Hants, the Trout are large, plump in appearance, and beautifully coloured. But if we entice the Trout of a Dartmoor brook with an artificial fly, we shall find that their average weight is under a quarter of a pound, and that they are darker and less golden than those of more generous streams. More marked still is the difference that we shall find in the almost black Troutlets that swim in the dark, peaty waters of a boggy fell

A MOUNTAIN STREAM.

in Cumberland, or in some mountain rivulets of Wales and Ireland.

One of Nature's means of protection for all animals, including fish, is the adaptation of their colour to the surroundings of their habitat. In some rivers there is a very distinct difference in the shade and spots of the Trout that frequent particular reaches. Where the river has a sandy, golden bed, the Trout are light in hue. In the deep pools of green water, the fish have a greenish tint on the back ; while in the peat-stained lengths of the higher waters the Trout are dark. This adaptation is so cunning that only the well-trained eye of the fisherman can detect the Trout amid their surroundings, and even the most observant of anglers fails to see scores of the fish on a clear, rippling shallow.

The instinct of concealment is very strong in Trout, and their cautiousness increases with their age. It is a mystery where big Trout hide themselves when a river is low after a long spell of drought. Not a fish can be seen from six in the morning until after twilight in those hundred yards of the stream. Yet at night this length will be ringed from end to end by rising Trout. During low water periods, many Trout travel to the deeper pools of the rivers, and those that remain in the shallows discover unsuspected hiding-places. They lie beneath big stones, in patches of weeds, and under the projecting ledges of the banks, or refuse to leave the broken waters of "runs," where their detection by the eye of enemies is difficult.

When a downpour of rain brings stained water into the stream, Trout are less wary and suspicious. The prospect of liberal fare brings them out of their lurking-places, and they distribute themselves in most parts of the river. If the spate, or flood, is high and the stream much swollen, Trout resort to the long pools, and congregate in the bays and

A RIVER POOL.

eddies out of the fierce rush of the water.

Long combat for existence has educated the Trout of our rivers to a remarkable

Photograph by Wilson, Aberdeen.
A FALL ASCENDED BY TROUT.
Leny Falls, Perthshire.

degree. There are streams that the angler calls "difficult," such as the crystal Dove, or the Darenth in Kent, wherein the Trout are so experienced in self-protection that even the most capable fisherman finds his skill severely taxed in competition with his wily prey. To tempt these shrewd Trout, the fly-fisher uses the most delicate of tackle and flies that are works of art. An unfamiliar shadow on the water, a dubious disturbance of the surface, no matter how slight, and the flash of a rod in the air, will scare these sophisticated fish into the deeps. Again and again they will refuse the most tempting counterfeit of a natural insect, presented with the rarest adroitness.

Very different, though not without cunning, are the Trout of remote lochs and unfrequented rivers. They have a less wide experience of the race of anglers, and the poverty of their food supply often makes them unwary. These are the Trout that rejoice the novice in fly-fishing, for their capture requires less skill than that demanded by their brethren of the much-fished waters.

October is a month of much importance in the life of the Trout. It is the period when the passion for wandering seizes the fish, and the one supreme object is that of migration to the spawning beds. If the tributaries are low, this is the time when the poacher reaps his plunder, for Trout, heavy with spawn, or bent upon pairing, are apt to expose themselves to danger in the shallow reaches of rivulets. In the surmounting of the falls of streams at this season Trout show a marvellous strength and pertinacity. I have seen a Trout, no longer than my forefinger, working its way from ledge to ledge of a tumbling cascade of fifteen feet in height, an obstacle that no salmon would venture to ascend. The abundance of Troutlets in the highest pools of mountain burns, above high falls, proves beyond question that these fish are possessed with a passionate love of exploring, and a wonderful capacity for mounting waterfalls.

WALTER M. GALLICHAN.

A TROUT LOCH.

THE CLIFFS AND THEIR STORY—I

By F. MARTIN DUNCAN, F.R.P.S.

With Photographs by the Author

THE white cliffs of old England! What a thrill of eager longing and pleasure that simple sentence brings to the hearts of those who are homeward-bound, after long absence in strange lands; and how eagerly are all eyes strained to catch the first glimpse of the fair white walls—Nature's ramparts—that guard our island home! Could they speak, those same white cliffs that tower above us so majestically, what wonderful stories could they relate of the changes that have passed across the face of the earth since they were called into being! But, although the cliffs cannot speak to us with articulate words, we can learn much of their past history by a little careful examination of their shape and composition.

"THE WHITE CLIFFS OF OLD ENGLAND."

With the aid of a geological map of England, we can trace the chalk underlying all that part of England situated to the south-east of an imaginary line drawn diagonally from the Dorset coast to Flamborough Head, though it is not visible at the surface all the way, but lies hidden beneath deposits of sands and clays. The southern edge of this great area of chalk formation has been crushed and distorted upwards by some great earth-movement of the past in a most remarkable manner, so that in the cliffs of the Isle of Wight and Dorset the chalk is to be seen standing perpendicularly on edge. A most delightful and interesting experience is to take a boat on a still, early summer morning, at Freshwater, Isle of Wight, and to let the boatman row you towards the Needles, keeping the boat fairly close in under the cliffs. Shortly after putting out from the shore, the scene becomes singularly impressive, the great white cliffs towering up many hundred feet into the deep blue of the summer sky. Save for the splash of the oars, and the quiet, mysterious

whisperings of the waves as they wash against the great rocks at the base of the cliffs, not a sound is to be heard. It is as if Nature herself paid silent homage to these majestic monuments of the dead past. Suddenly the solemn hush is broken

"A NARROW BAY THAT FACES THE NEEDLES."

by peals of uncanny laughter and shrill calls from the ledges on the vertical face of the cliffs. It is the laughter of the nesting gulls, disturbed at our approach. Numbers swoop and circle over our heads, uttering their shrill, plaintive cries. A narrow bay that faces the Needles affords delightful facilities to study our subject. The shore is practically composed of shingles, and on all sides there is ample evidence of the action of the waves upon the base of the cliffs, which helps us to realise how the Needles have become separated from the island by the combined action of the atmosphere and the waves. Should there have been a recent fall of *débris* from the face of the cliff we shall probably be able to collect from amongst the freshly-exposed masses some of the fossils peculiar to the chalk formation.

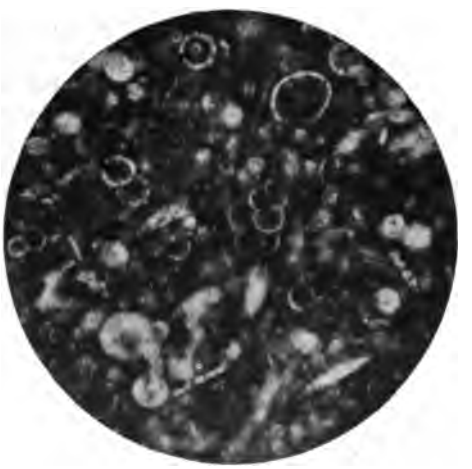
Now let us see if we can find out of what materials the chalk cliffs are composed, and how they came to be formed. To do this, we must call in the aid of the microscope, so that we may examine the minute structure of the cliffs. If we make a very, very thin section, or slice, of a piece of this chalk broken away from the cliff, and place it under the microscope, we shall see that it is very largely composed of countless minute bodies, more or less symmetrical in shape, each built up of a number of globular chambers, arranged in a series. Scattered amongst these prevailing globular bodies are other minute shells, some resembling tiny replicas of the beautiful Nautilus shells to be seen in our natural history museums, together with sponge-spicules, etc.; and all are embedded in a fine white dust composed of carbonate of lime.

For many years the chalk cliffs were a bone of contention and a great puzzle amongst geologists, who were engaged in striving to piece together the evidence which should show how this vast area of chalk had been formed in the past. One great question was how to reconcile the fact that chalk is almost identical in its chemical composition with ordinary limestone, with the conflicting fact that it is of an absolutely distinct internal struc-

ture. Then there was also the question of the preponderance of the oval-chambered bodies in the chalk, and the invariable absence of those organic remains

A SECTION OF CHALK, SHOWING FOSSIL REMAINS OF *FORAMINIFERA* AND SPONGE SPICULES.

which are always prevalent in ordinary limestone; and why flint, which is so rare in ordinary limestone, should be so abundant in the chalk. The fossil remains of sea-urchins, marine shells, corals, fishes, etc., all proved that the chalk, like the



A THIN SECTION OF CHALK IS SEEN TO BE CHIEFLY COMPOSED OF THE SHELLS OF GLOBIGERINÆ.

majority of the limestones, must have been formed beneath the surface of the sea, without, however, accounting for the characteristic differences of the two formations.

It has been one of the triumphs of biology that it has solved these puzzling questions, and clearly demonstrated how the chalk has been formed; and it is to the able and untiring investigations of the late Professor Huxley, Dr. Wallich, and Dr. Ehrenberg that the problems of the chalk formation have been solved.

Prior to the laying down of the first telegraph cable between Ireland and Newfoundland, a survey was made of that part of the bed of the sea upon which the cable was to rest; and the samples of mud dredged up during this survey were sent for microscopic examination to Professor Huxley and Dr. Ehrenberg. The mud obtained by the survey expedition was generally a whitish-grey in colour, and

OSTREA CARINATA: A FOSSIL OYSTER FOUND IN THE CHALK CLIFFS AT DOVER.

because of its peculiar characteristic appearance received the name of "ooze." When some of this ooze was examined under the microscope, it was at once seen to be largely composed of the same globular bodies that are such an important characteristic of the chalk—the shells of a most interesting minute creature called, from its globular shape, the Globigerina. So, on account of the predominance of these globular shells in the mud, it has been called the "Globigerina ooze."

The result of these deep-sea dredgings and their microscopical examination was to demonstrate that over a great part of the bed of the North Atlantic a very wonderful deposit of the Globigerina ooze is being formed. This consists almost entirely of an aggregation of the microscopic shells of the Globigerina, a creature belonging to a wonderful

and beautiful group of tiny organisms called the *Foraminifera* — microscopic creatures with perforated shells. The tiny Globigerina spends the greater part, if not the whole, of its life on the

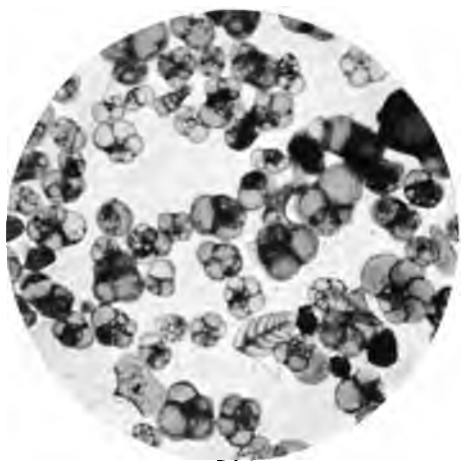
FORAMINIFERA FROM THE SURFACE OF THE SEA.
Note how closely they resemble the fossil forms found in chalk.

surface of the sea, where it forms its minute shell, which only measures between $\frac{1}{250}$th and $\frac{1}{300}$th of an inch in diameter, out of the carbonate of lime which the little creature extracts from the sea-water, and from the organisms upon which it feeds. This shell is composed of several globe-shaped chambers, the walls of which are pierced by numerous minute holes, through which the creature protrudes a network of delicate protoplasmic threads, by means of which it captures its food.

When they die, the Globigerinæ slowly sink to the bottom of the sea in countless numbers, where they accumulate and form about 85 per cent. of the ooze. In this way a constant rain of millions upon millions of these shells is for ever falling from the surface waters to the floor of the Atlantic Ocean, where they are slowly building up a chalk formation which is identical in general character with the chalk cliffs of England, and which in the fulness of time will rise, or be thrust by some great submarine upheaval, above the surface of the sea to form, perhaps, a new Albion or Atlantis.

Such, in brief, is the story of the white chalk cliffs of England. In the dim geological past they were formed beneath the surface of an ancient sea that covered the Western half of the Old World from Britain to the Hindoo Koosh. Gradually, through the passage of the centuries, they have been raised above the sea and have assumed the form and appearance with which we are so familiar.

Solid and majestic as they look, Nature is at work upon the cliffs with her keen tools—the rain, the winds, the frost, and the waves—slowly but surely smoothing and wearing them away. Those portions which fall into the sea are crushed into the finest particles and carried away by ocean currents to be absorbed by and built up into the shells of the *Foraminifera*, the rest to sink slowly, along with those minute shells of the Globigerinæ, to the floor of the ocean, to help in the formation of the chalk cliffs of a future land. Truly, as we examine those towering, majestic chalk cliffs, and realise how Nature is for ever at work upon them, changing, though ever so gradually per-



OOZE FROM THE BOTTOM OF THE NORTH ATLANTIC.
It is composed almost entirely of Globigerina shells.

haps, their shape, the beauty of Tennyson's lines, and their perfect description of what is for ever taking place, is vividly brought before us—

"The hills are shadows, and they flow
From form to form, and nothing stands;
They melt like mist, the solid lands,
Like clouds they shape themselves and go."

F. MARTIN DUNCAN.

THE SLEEP OF PLANTS

By S. LEONARD BASTIN

With Photographs by the Author

AS the sun sinks towards the western horizon a very great change comes over the countryside. Already the birds and insects which were so busy at high noon begin to feel the approach of the night, and turn their attentions to the question of where they may safely spend the hours of darkness. Amongst the plants, too, the failing light in the late afternoon is the signal for a great preparation, without which the well-being of vegetation would be seriously endangered. The great Linnæus, walking in the fields and gardens at dusk, saw that a very obvious alteration had taken place in the bearing of many plants. The foliage seemed as if it were gathered together, whilst many a flower head, which had been erect and open in the sunshine, was now drooping with closed petals. It scarcely seems that the naturalist really grasped the true meaning of the phenomenon which he noticed, although his was certainly a pleasing fancy that designated this evening change as the "sleep of plants." Modern research has done a good deal, it is to be feared, to dispel this romantic idea, for we now know that plants do not sleep in the sense of the word as applied to the taking of rest.

DAY POSITION OF CLOVER.

NIGHT POSITION OF CLOVER.

Indeed, at the time when the plant is in its most active state of growth, certain processes, such as the elongation of stalk, for instance, take place more vigorously in the darkness than during the day-time.

WOOD SORREL: DAY POSITION.

Despite the fact that we cannot say that plants commence a period of repose with the coming of evening, the state upon which they enter at this time will almost justify us in saying that they go to sleep. We must remember that it is only during the hours of bright daylight that the elaboration of the wonderful chlorophyll—the vital green part of the plant—can take place. It is likely, also, that the sap movements are much less vigorous at night than when the exhalation of moisture is being stimulated by the action of the hot sun on the leaves. Moreover, as with the animal, so it is with the plant, the night is a time of danger; two great enemies will be abroad—cold and damp—and it is to guard against the damage arising from these conditions that all the precautions of the plant are taken. To restrain a plant in such a way that its flowers and foliage are kept expanded throughout the night, is in many cases enough to bring about the death of the poor subject.

It must have fallen to the lot of most people to walk in a field of clover about an hour before the sun actually dips below the horizon. A very great change has just come over the little plants, for instead of the trifoliate leaves being fully expanded to the light and air, the leaflets are gathered together, whilst even the stalks bend slightly towards the ground. The whole appearance of the plant suggests that it has huddled itself up in order that it may keep warm; and this is actually the case. Experiments have shown that if the leaflets of a clover plant are fixed in such a way that they cannot close, and are then exposed to the low temperature of a clear night, the delicate foliage will be badly damaged. On this account a wise provision of Nature has ordained that the clover leaves shall be extraordinarily sensitive to light; this is so much the case that even on a dull day the foliage will be found to be partly closed. These sleep movements are to be observed not only in the clovers, but as well in almost all the other members of the great leguminous tribe. The pink Rest Harrow, the dainty Ladies' Fingers, the Meadow Vetchling, to mention only three common pod-bearing species, each and all show a slight change in the bearing of their foliage during the night-time.

WOOD SORREL: NIGHT POSITION.

Another little plant which goes to sleep in a very pretty fashion is the Wood Sorrel. The foliage of this *Oxalis* is curiously responsive to all sorts of conditions; so much so that it may well be called the British Sensitive Plant. Even to blow the foliage briskly is to bring about a folding of the leaflets, whilst a heavy cloud will induce the gathering together of the foliage. Long before the daylight has really fled, the pale green leaves are preparing themselves for the chill dews of night, whilst the flower heads hang down in a very disconsolate manner.

DAISIES BY DAY AND NIGHT.

Although it is a matter upon which we have not much definite knowledge, there is little doubt that these day and night positions on the part of plants are brought about by changes in the distribution of water in the cellular tissue. In some way the waning light induces an alteration in the turgidity of the cells, with the result that the tissue loses its tenseness, and the leaf collapses.

It is not only in the plant as a whole that striking changes take place at the approach of evening. Quite as important as the shielding of the foliage from cold, is the protection of the pollen from damage by the heavy dew deposits. To this end some of the most beautiful adjustments in the whole floral world have been brought into being, many of these really marvellous examples of Nature's forethought. At noon the meadow grass is starred all over with Daisy flowers, but some time before there is any very appreciable difference in the degree of light, the little blossoms begin to close their "sleepy red eyes." The pollen produced by the central mass of true flowers would be seriously injured by the falling dews of evening did not the encircling florets gather inwards to shelter it from the moisture. Perhaps even more striking is the behaviour of the garden Eschscholtzia, a well-known plant hailing from California. This species is a member of the Poppy tribe, and has the typical cup-shaped flowers, which under the influence of the midday sun expand to their fullest extent. So early does the flower go to bed, however, that even at midsummer the glowing orange and yellow corolla will be folding itself up by three o'clock, whilst an hour later the whole flower will be completely closed. It is rather curious to consider how it is that the Eschscholtzia can be so quickly influenced by the waning light in the early afternoon, especially when it is remembered that the flower opens

THE WATER LILY BY DAY AND NIGHT.

ESCHSCHOLTZIA: DAY POSITION.

in the morning long before the sun has attained its maximum altitude. We cannot but feel that we know very little about the real action of light upon the petals of flowers.

A very long time ago it was noticed that the Water Lily went to bed at night, and in the morning rose up to meet the sun. In his dainty "Reveille," Shakespeare tells of the "chaliced flowers that rise," and he can only mean the grandest of our native blossoms—the White Water Lily. When the flower of the Water Lily is fully expanded it is very much exposed to the elements; and although the plant grows with water all around it, the golden pollen must be kept free from moisture. Moreover, with such a large surface as is offered by the big open flower, there would be a serious loss of natural heat during the night. Even in the long June days the temperature falls very low at the coolest part of the twenty-four hours. So at the approach of evening the petals and sepals of the Water Lily close inwards, and the whole blossom, no longer spread out raft-like on the surface of the lake, sinks down until only about a third of the bud is visible. Thus in the equable temperature of the water the night is passed without injury, and the pollen is shielded from the heavy dews of the dark hours. The spare length on each Water Lily stalk makes this rising and falling quite a simple matter.

It is not by any means every plant which closes its flowers during the night-time. Plants, like almost everything else in this world, are very much the victims of circumstance, and whilst in a broad sense the blossoms may be called the children of the sun, there are quite a number of instances in which the flowers positively refuse to respond to the glowing rays. In the garden and out in the hedgerows we may find plants producing flowers—usually white or light-coloured—which all the day long are closed and unattractive; the very waning light, which means bed-time to most flowers, induces these species to expand their blossoms to the fullest extent. Two typical examples may be found in the White Tobacco Plant of the border, and the Evening Campion of the fields. Now in almost all the cases of these plants which are alert at night, it is to be found that some insect is closely associated with the scheme of fertilisation; and this particular species only flies during

ESCHSCHOLTZIA · NIGHT POSITION.

RED CAMPION AT MID-DAY.

the hours of darkness. Thus the Tobacco flowers are visited by the long-tongued hawk-moths, whilst the Campion attracts other night-flying species. It is remarkable how clearly the white discs of these flowers show up even on a dark,

WHITE CAMPION AT MID-DAY.

WHITE CAMPION AT 6 p.m.

cloudy night, at times appearing to gleam, almost as if they were phosphorescent. This effect is probably due to the exceeding purity of the white petals. It is certainly a difficult problem to solve, as to why it is that the petals of these night-blooming species are influenced in an opposite way to ordinary flowers by the failing light. Still more strange is it to observe that whilst the White Campion only displays its flowers during the night, the Red Campion behaves in an exactly reverse manner. Its flowers being coloured, would make no show at night, and we may, therefore, find them fully open under the mid-day sun. These distinct habits are all the more remarkable, when we remember that the two forms are so closely related; indeed Hooker considered that the Red Campion was only a variety of the white species. It is not a little remarkable that an alteration in colour should involve such a complete change in the habits of a plant as is seen in the case of the Campion.

S. LEONARD BASTIN.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.
Author of "Wee Tim'rous Beasties," etc.

THE SHREW MICE—I

THE WATER SHREW MOUSE. THE COMMON SHREW MOUSE.
THE PYGMY SHREW MOUSE.

With Photographs by the Author

UNLIKE the allied Hedgehog and Mole, who have, in a sense, compelled observation—the one by the spiked defence with which he is surrounded, the other by the mysterious earthworks with which he surrounds himself—Shrew Mice, owing to their small size, the indeterminate nature of their runs, and their superficial resemblance to mouse kind in general, have failed to secure, either from author or artist, the attention which their qualities deserve. Such interest as they have aroused has, unfortunately for them, been chiefly of a superstitious character. Topsell pictures them as ravening, venomous, cruel and fraudulent.* Gilbert White contents himself with a description of the "Shrew Ash" ceremony, which has been copied from book to book to the present day, and has found, it is to be hoped, its last resting-place in Millais' ponderous volumes.

* "History of Four-footed Beasts and Serpents." London, 1658.

The superstition that Shrew Mice are in some fashion venomous, is ancient and widespread, and it may be in consequence of this superstition that so many pictures of Shrew Mice appear to have been drawn (at a respectful distance) from dead specimens. Such drawings tend to promote rather than to decrease ignorance, and if my photographs serve, as I trust they may, to dispel the illusion that a living Shrew Mouse's nose curls normally downwards, that there is a deep depression on the nape of his neck, and that his fur presents in life a sodden and spirituous appearance, I shall feel compensated for the labour and disappointments which this particular branch of photography have involved.

The keynote of the Shrew Mouse's character is restlessness. Most animals adopt, on occasions other than those of rest, attitudes which though suggestive of movement are nevertheless appreciably maintained. It is on the instant recognition of these attitudes, a power which

can only be acquired by an intimate acquaintance with the animals themselves, that the successful photography of small animals mainly depends. Other things being equal, the larger the animal the easier the work of the photographer.

The Shrew Mouse, however, is never still unless he is protected by cover. He may pause in his stride, as it were, and rear himself up to look about him; he may check his own progress by splaying his hind feet almost at right angles to his body and waddling on these alone; he may bunch himself into a sitting

The Pygmy Shrew Mouse.

The Common Shrew Mouse.

The Water Shrew Mouse.

THE THREE BRITISH SHREW MICE.

position with his hind feet hidden beneath him (curiously enough Shrew Mice often die sitting); but, though body and feet may on such occasions be stationary, head and snout are quivering with redoubled energy, and I have little doubt that the Shrew Mouse depends largely on the crown of bristles which encircles the latter for a clear (possibly a tactile) sense of his surroundings. The importance of these bristles (*vibrissæ*) is rendered evident by the presence of well-defined muscles to control them.

A peculiar feature of the Shrew Mouse's brain points to the probability of his possessing an extremely keen sense of *smell*. We must therefore regard his snout, taken as a whole, as a highly specialized organ, and if, as seems likely from the size and position of his eyes, his range of vision is limited, it may well happen that he finds compensation in his extended and delicate senses of smell and touch.

WATER SHREW MOUSE.
Preparing to dive.

So far as hearing is concerned, it is difficult to make any crucial experiments with a creature so nervous, restless and highly strung as the Shrew Mouse. A sudden clap of the hands will make him "jump out of his skin," but this may well be due to terror at the vibration of his surroundings. I have never succeeded in attracting his attention by a soft squeak such as will cause a house mouse to be "all ears" in a moment, nor does a human imitation of his own note, which closely resembles that of the Sabre-tailed Grasshopper (*Thamnotrizon*), appear to interest him.

His ear, nevertheless, presents certain peculiar features. The conch is circular and almost hairless, both front and back. The Shrew Mouse has the power of contracting and folding it in such a way that it may be completely concealed under the surrounding fur. Within the conch are two lobes, or valves, the upper of which is heavily haired on its borders and partly detached from the conch itself, while the lower (a smaller one) seems to be formed by an infolding of the conch, and serves to close or open the entrance to the internal ear.

To the Water Shrew Mouse this structure is probably of some service, for by means of it he can effectually prevent the water entering his ears when he dives; but it is more difficult to estimate its utility in the case of our two land Shrew Mice, and I have not been able to determine the reason why a land Shrew Mouse prefers at one time to keep his ears wide open, while at another time he prefers to keep them hermetically sealed.

In all our three species of Shrew Mice the hair is of similar structure to that of the Mole.

The velvet softness of the Mole's fur is probably familiar to most of my readers. The fur of a Common Shrew Mouse in good condition is softer still, while that of the Pygmy is the softest fur known to me. It is fortunate for him that his skin is of a corresponding delicacy, and that it would take many thousands of him to make a fashionable garment. But softness is not the only peculiarity of Shrew Mouse fur. The pelage of the Pygmy Shrew Mouse (and of the immature Common Shrew Mouse) displays an iridescence which has been compared to watered silk or to the gorget of a humming bird. To my mind, however, the iridescence is of a less blatant character, and can be more reasonably compared to the bloom on certain fruit. The

A Momentary Rest.

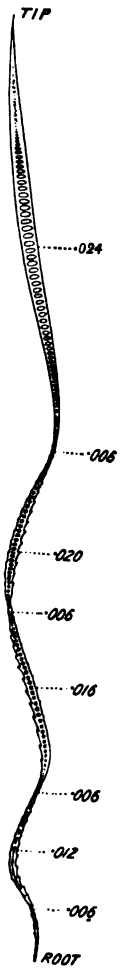
Characteristic Attitudes when Climbing.

On the Forage.

STUDIES OF SHREW MICE.

tinge of delicate purple which can, under certain conditions of top lighting, be seen on the shadowed portions of an orange plum, can be fairly matched by the appearance of a Pygmy Shrew's fur under a similar illumination.

The explanation of this iridescence, or bloom, as I prefer to call it, is to be found in the structure of the individual hairs, and this structure also accounts for the velvet quality of the fur as a whole. It has been very frequently stated that the hairs of the Mole are rooted perpendicularly in the skin instead of sloping with a definite "set" from front to back. I have not been able to find any justification for this statement, and I think that the absence of any definite "set" in the fur of this class of animal is to be more naturally explained by the fact that each individual hair is composed of five thicker, and four narrower portions in alternate order. Taking the hair of the Common Shrew Mouse, and starting at the root end, we find that transverse measurements at the centres of the alternate wide and narrow portion work out as follows: ·008 millimetres, ·006 millimetres, ·012 millimetres, ·006 millimetres, ·016 millimetres, ·006 millimetres, ·020 millimetres, ·006 millimetres, ·024 millimetres. From the last point of measurement the hair tapers to the tip. At each of the four narrow portions, where the remarkable fineness of ·006 millimetres occurs, the hair makes an abrupt bend, and these bends are in alternate directions. Each standing hair, therefore, yields to the touch in four different places at once, a fact which accounts not only for the velvet softness of the fur as a whole, but also for the absence of a set in any definite direction. So far as the bloom is concerned, I think we may find a certain analogy in the wavy hair, of which certain human beings are the fortunate possessors. Wavy hair tends to scatter and reflect light in opposed directions, and when, as is the case with Moles and Shrew Mice, the wave of the hair is combined with extreme fineness, a colour-effect produced by light-interference may reasonably be expected. While making the above measurements (and I would here take the opportunity of expressing my indebtedness to my friend Mr. O. H. Latter for his assistance in the matter) it occurred to me that the alternation of thicker and thinner portions in each hair, as viewed under the microscope, might arise from the hair being more or less ribbon-shaped and twisted spirally, so that one saw alternately the width and the edge of it.



SKETCH DIAGRAM OF HAIR OF SHREW MOUSE.

The possibility of this was suggested by the fact that from the root end to about the middle of the hair there appeared to be short lengths of serrations on *alternate* sides.

Successive cross sections have shown me, however, that the hair is cylindrical for the greater part of its length, and that it is only where the spear tip is reached that it tends to become elliptical in cross-section, owing to a slight flattening of the cells which compose this portion of it.

While we are on the subject of hair, mention should be made of the side glands in the male Shrew Mouse, which can best be detected by the feel of the coarser hair immediately surrounding them. They are especially developed in the spring, and as may be seen from the illustration on page 309, are situated on the animal's sides at points rather forward of the middle of his body. They consist of two oval patches (orange-coloured on their under surfaces) in the centres of which are small, thick protuberances surrounded by stiff, coarse hairs. Sections through these patches show that they are true glands, containing ducts, and the secretion from them probably helps to create the disagreeable musky odour which is peculiar to the animal, and which is most searching when the animal is annoyed. That they are not wholly responsible is

shown by the fact that the females of our three British species contrive to be similarly odoriferous without their assistance.

Shrew Mice of both sexes possess what are known as " hibernating " glands. These develop as winter approaches, and disappear completely in the spring. They are situated on the animal's shoulders, and consist of four symmetrical tongue-shaped masses of yellowish tissue, each about 16 mm. long, and at its widest portion 8 mm. broad. What function they perform is uncertain —it is even uncertain whether they are glands at all, or merely masses of fat. It is evident, however, from their constant and symmetrical form, and their periodic appearance and disappearance, that they are, in some way, definitely connected with the animal's winter economy.

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1. The remarkable "hibernating glands" of the Shrew Mouse, which develop just beneath the skin on the animal's shoulders towards the winter and disappear entirely in the spring.
2. Front view of head of dead Shrew Mouse, showing the remarkable development of the whiskers (*vibrissæ*).
3. A Shrew Mouse skin with the fur parted to show the scent glands on the animal's sides.

Until quite recently it was the fashion to maintain that Shrew Mice hibernated; it is now the fashion to assert, with equal confidence, that they do not hibernate. Much, of course, depends on what is meant by hibernation, but even when we allow that the word is open to more than one interpretation, we can hardly settle the question without close observation of living Shrew Mice during the winter months. I do not know that such observation has ever been accomplished. For my own part I have found Shrew Mice difficult to keep alive for more than a few months in spring and summer, and I have never been able to tide them over a winter.

At the same time I incline strongly to the opinion that a Shrew Mouse, faced by a rapid diminution of his food supply such as would inevitably occur in a hard winter, must either relapse to a torpid condition—in which he can subsist on rare and occasional meals—or die. I have more than once recently observed a Shrew Mouse burrowing in soft soil, and his tunnel, though small, is as neat as that of the Mole, but his burrowing powers are obviously limited by his size, and the hibernating glands, whether they be true glands or merely masses of fat, afford strong presumptive evidence that, as the cold approaches, his organisation is profoundly modified.

I have occasionally trapped Shrew Mice during hard weather, but on consulting my records I have found these occasions so rare, comparatively, that I have modified my previous opinion that Shrew Mice were active from year's end to year's end.

DOUGLAS ENGLISH.

HOW TO KNOW THE TREES GROWING IN BRITAIN

With Notes, descriptive and photographic, for their Identification in all Seasons of the Year

By HENRY IRVING

THE MULBERRY

THE Mulberry is but a small tree. Its associations are aristocratic. The presence of a Mulberry tree on the lawn, so it is said, is itself a patent of nobility. This tree is usually found in grounds that are, or have been, attached to "stately homes." Specimens survive from far-away times,

THE MULBERRY IN WINTER.

venerable with age and reminiscent of courtly dignity. Some of these, as at Syon House, date back to pre-Reformation times, marking the site of some ancient monastic institution long since put to other uses. Many that still survive were planted in the time of James I., who made great efforts to bring about their general introduction with a view to the establishment of the silk industry here. Planting the Mulberry, therefore, became in his and succeeding reigns a matter of courtly fashion, sedulously observed by courtier nobles. So our courtly Shakespeare followed suit in his garden at New Place, Stratford-on-Avon, though house and tree both fell later under the hand of the vandal. Yet cuttings were struck from this tree and afterwards flourished, and a small specimen in direct descent may be seen in the Royal Gardens at Kew. In this connection it may be remembered that Milton also planted a Mulberry tree which still survives in the grounds of Christ's College, Cambridge.

Two kinds of Mulberry tree are found —the Black and the White. The Black Mulberry is the hardier and best suited to our English climate. Indeed, it flourishes well even in the smoke of the town. Mulberry trees annually bear fruit in the heart of London, as in the Charterhouse Gardens and in Finsbury Circus. The main difference between the two kinds of Mulberry is in the colour and texture of the leaves and in the fruit.

LEAF OF THE MULBERRY.

TRUNK AND BARK OF THE MULBERRY.

In *winter* the Mulberry shows sturdy branches, which commence rather low down, the lower ones often showing a tendency to take the horizontal direction. These strong branches divide and subdivide considerably in sinuous curves, ending in numerous crowded twigs.

In *spring* the tree is one of the latest to put forth its leaves, waiting till all danger from frost is over.

In *summer*, as the leafage becomes full and mature, the tree shows a dense, rounded crown, which affords ample shade, and varies in colour according to the class to which it belongs.

In *autumn* the fruit becomes conspicuous, changing from green through shades of red, and, in the black variety, to purplish black. The leaves slowly assume their yellow fading tint, but

WINTER TWIG OF MULBERRY.

remain on the tree some time after those of most other trees have fallen.

The *bark* is thick and roughened into vertical folds, reddish brown in colour.

The *winter twigs* are stout, and have the peculiarity of emitting a milky fluid when cut. The *resting buds*, arranged alternately on the twigs, are broad at the base, somewhat flattened and pointed. They are protected by scales, and stand on prominent bases. The *leaf-scars* are large, almost saucer-shaped, and show from five to seven leaf-traces, more or less grouped.

The *leaves* vary somewhat, but may be described as generally heart-shaped, though at times, especially in the case of the White Mulberry, they have one or more deeply cut incisions on each side. The margin is irregularly toothed. The colour in the black variety is a dark green, and the texture is rough and hairy; but in the white variety the colour is much lighter and the surface smooth and shiny. The midrib passes direct to the apex, with six or seven pairs of side ribs, the lower pair of which start from the base of the leaf, and each throws out six or seven strong tertiary ribs to support the lower leaf extension.

The *flowers* are distinct—the pollen-bearing from the fruit-producing. Both kinds may generally be found on the same tree, but not always. In some instances, especially in the case of the Black Mulberry, one kind only—pollen-bearing or fruit-producing flowers—will be found on a tree. The Mulberry thus shows a tendency to break from the rule observed by all the trees previously noticed. It comes midway between these and the others to be next considered, the Poplars and Willows, in which, without exception, every tree specialises, producing one kind of flower only. Evolutionary changes, though the work of long ages, are always in progress, and the Mulberry is now at the distinctly transitional point in its life-story, where a tendency to differentiate between a pollen-bearing and a fruit-producing tree becomes evident, in the endeavour to secure the positive advantage of assured cross-fertilisation. The pollen-bearing flowers are grouped into loose, catkin-like green tassels, near the base of the young dwarf shoots. The pollen dust, which is conveyed by the wind, is greenish white. The fruit-producing flowers, bunched into short spikes, stand out also about the base of the dwarf shoots, and occasionally at the junction of the lower leaves of the same with the shoot.

RESTING BUD (ENLARGED) OF MULBERRY.

The *fruit* is really a crowded cluster of stalkless stone fruits, very juicy, and with "skins" that easily rupture. This fruit cluster has the appearance of a large, somewhat elongated blackberry; though, unlike the blackberry, it is the product, not of one flower, but of many.

HENRY IRVING.

THE GARDEN AT HARLEYFORD MANOR, GREAT MARLOW.
From the Water-Colour Drawing by E. A. Rowe.

Photograph by F. Mason Good, Winchfield.

"IN AUTUMN THE GARDEN DEPENDS FOR ITS CHARM LESS, PERHAPS, ON FLOWERS THAN ON LEAVES."

THE GARDEN IN AUTUMN

By H. H. THOMAS

THOUGHTS of autumn in the garden are tinged with melancholy, for this is the season of the passing flowers. How mournful, how sad is the fading of the flowers! How they are fallen! It seems only the other day that the garden was in the full flush of its beauty, brilliant with opening blossom, redolent with the scent of fragrant petals. How ephemeral is their loveliness! If only the flowers would die a beautiful death, possibly we should feel their loss less keenly, but since they droop and wither to a mass of rotting petals, involuntarily we think of the beauty that once was theirs and conjure up visions of the summer that has gone. To dream dreams of a happy past is invariably to feel dissatisfaction with the present. Thus arises that tinge of sadness, that touch of melancholy, indissolubly bound up with thoughts of autumn, not because autumn itself is actually a dreary time, but because, by unconscious comparison, we liken autumn, not to autumn but to summer. Such comparison can bring nothing but lamentation. How great a mistake it is to compare the present with the past, and especially one season of the year with another! Each season,

whether spring or summer, autumn or winter, has its own perfect beauty did we but understand and fully realise the charm of those of Nature's sights and sounds that for the time being environ us.

It is true there is nothing beautiful in the passing of the flowers, "which droop and die most melancholy." But has not autumn her own fair blossoms that even the summer sunshine cannot coax from bud to bloom, that open only when a soft haze veils the blue heavens, and a refreshing dew moistens the parched earth and wizened leaves? Yes, there are lovely flowers that delight in the waning sun, the shortening days and lengthening nights. There are many of them, and it is largely due to their presence that the autumn garden owes its magic charm—a charm as satisfying, as complete, as that compelled by the galaxy of glowing colour in summer-time. Even if we could have beds and borders gay with gaudy bloom in autumn, it is unlikely that under the grey skies and hazy atmosphere we should appreciate them. The happiest results in gardening are obtained only when each plant is allowed to blossom in its natural season—to retard summer flowers for the embellishment of the garden in autumn is a certain way to create incongruous effects. At this season how appropriate and how harmonious in Nature's vast colour scheme are the greys and mauves and lavenders, bronzes and yellows—shades that now predominate among garden flowers. The former are in perfect accord with the spirit of autumn that comes clothed in a grey shroud, as though in half-mourning for the showy summer flowers; while the latter give welcome relief and splashes of appropriate colour in the prevailing sombreness and hazy gloom. But in autumn the garden depends for its charm less, perhaps, on flowers than on leaves, for while blossoms fade with an ugliness that is depressing, leaves die a glorious death. It is only in dying that leaves taste to the full the joy of living; now is the supreme moment of their lives. From a monotonous prime they pass to an enchanting old age; as the spirit of autumn illumines them they come to their fullest beauty.

How wonderful it is that while we mourn the loss of the summer flowers, the woods and copses, the trees and shrubs are radiant with autumn's glow, which touches them to such beauty as summer never knew—a beauty that transcends the rich colour feast of June blossoms at their best! How wisely Nature orders the goings of her leaves and flowers! How perfectly the balance is adjusted! Even when beds and borders are aglow with brilliant bloom, although one may scarcely realise it, it is nevertheless true that much of their charm is due to the environment of cool green leaves, that provide such a perfect setting, such an admirable background to the many tinted flowers. The skilful gardener does not attempt to make a garden of plants that depend for their charm on flowers alone; he realises the great value of soft-toned leaves, and puts to practical use their infinite variety of form and tint, with the result that a natural garden scene unfolds.

With the passing of the flowers comes the glory of the leaves. In early autumn the garden glades are an amazing and impressive sight; from end to end a mass of colour and shades of colour all woven and interwoven in Nature's patterns by her own incomparable skill. The Elm and Oak and Beech, the Birch, queen of the woods, perfect in grace of form and tender colouring, the Rowan, Chestnut and others play their part in the weaving of the woodland tapestry; they make a picture whose impression is ineffaceable from memory, serving to bring home to one the inmiitable fascination of wood and garden when autumn falls.

"Upon the hazel gray
The lyre of autumn hangs unstrung,
And o'er its tremulous chords are flung
The fringes of decay."

What depth of wisdom lies in the ordering of so glorious a death for the leaves; it is only by comparison with the fading of the flowers that we can realise its majesty, and appreciate the gulf that exists between the beauty of the one and the unloveliness of the other. Strange that from captivating beauty flowers should fade to ugliness, while from commonplace monotony leaves die in a splendour that for the time trans-

cends everything in Nature's realm! And it is not only in the trees and shrubs that this sublime colour display is seen, although there, of course, it is most prominent, for the leaves of many a weed and wastrel plant pass to their death in dress of exquisite dye.

But Nature's own garden depends not quite alone on changing leaves for autumn charm; some of her wild plants show a rich beauty when the sun sinks in the heavens and the nights are cold and chill. There is the Traveller's Joy or Old Man's Beard, as the wayside Clematis is variously called, never more beautiful than when the flowers have given way to the feathery fruits that cover the giant shoots from tip to base with a soft grey shroud. How perfectly they accord with the environment of the countryside in autumn — of Nature's great garden of leaf and blossom — with changing leaves and the ripening fruits of Blackberry, Sloe, Crab, Thorn and Wild Rose. Even the hedgerows have their autumn beauty; the orange-red fruits of the Cuckoo Pint or wild Arum Lily peep out from the roadside ditch as if anxious to show themselves to the passer-by—little clusters of rich colour amid dead and dying weeds. The fruits of Bryony, Honeysuckle, Dog Roses,—these and others less familiar make even a wayside hedge a thing beautiful to look upon.

It is in the garden proper that autumn flowers are seen at their best, for the countryside depends for its chief beauty on the glow of the dying leaves. Within the garden it is different, although the woodland trees that encompass it provide a feast of colour and an ideal fringe. Within there is blossom in abundance, real autumn flowers that open only to the misty days and dewy nights. Perhaps finest of all true autumn flowers are the Michaelmas Daisies that give so prodigally of soft-toned blossoms which hide the

Photograph by F. Mason Good, Winchfield.

LATE AUTUMN IN A SHROPSHIRE FARMHOUSE GARDEN.

Photograph by F. Mason Good, Winchfield.

AN AUTUMN DISPLAY IN THE HON. MRS. VERNER'S GARDEN, HARTFORD BRIDGE, WINCHFIELD.

stems that bear them. Their graceful masses of grey, soft pink and tender mauve seem in perfect harmony with their surroundings, they are characterised by a softness, a pensive wistfulness that seem to possess the air and pervade the garden. There is beauty as exquisite in the subtle harmonies of the autumn garden as in the brilliant colour contrasts of summer bloom; each is fully appreciated in its season. With the fall of autumn there comes an influence that seems to alter one's point of view, so attuning one's sense of perception that the tender tones of the autumn flowers appear to have as rich a beauty as those of any other time.

There is no more charming colour picture in the autumn garden than the outer fringe, where the mauve and grey bloomed Asters are massed around the white and slender stems and beneath the golden leaves of the Silver Birch. The flowers and leaves combine to form one of the most exquisite associations of tree and blossom I have seen, one that is of the spirit of the autumn mists. Then the Japanese Anemones that throw their white blossoms so gracefully above the leaves are among the most attractive of autumn flowers. A striking garden picture results if one plants the autumn Lobelia, that bears bright scarlet blooms on bronze-coloured stems some three feet high, with the Japanese Anemones. Then the Montbretias, Sunflowers, Coneflowers, Chrysanthemums, Gladioli, and Dahlias play an important part in the autumn garden, making splashes of rich colour in the prevailing grey. And Rose and Clematis, how they glow in the drab gloom! What would the autumn garden do without Roses? Their fragrance may not be so pronounced now as in the evening of a summer's day, but there is still warm colour in the petals and a glamour that is always theirs surrounds them. Some of the finest autumn blooming roses are the magnificent white Frau Karl Druschki, Madame Ravary, whose petals are of a

soft apricot tinge, Lady Battersea, elegant in bud and light crimson in blossom, Caroline Testout, with large pink flowers, Hugh Dickson, that bears deep crimson blooms having a pronounced fragrance, Lady Ashtown, and Mme. Abel Chatenay, of salmon pink shades, the primrose yellow G. Nabonnand, and many more.

The tufted Pansies and Drummond's Phlox, in many shades of colour, that have kept the Roses company all the summer through, are still full of bright fresh bloom. Then there are Tiger Lilies, Japanese Lilies, the Golden-rayed Lily, Tuberous Begonias, Belladonna Lilies, Torch Lilies or Kniphofias, the panicled Hydrangea, Pampas Grass, the Monkshood, tall Moon Daisies; each and all bring beauty to the autumn gloom, a beauty that owes nothing to garish colouring but everything to the happy association of tender tints. And the grey-leaved plants, the Pinks, Lavender, Rosemary, Globe Thistles, Sea Holly, Giant Cotton Thistles, all are beautiful to look upon. Night in the autumn garden is an enchanting time. Even the very petals that expand to the mist-veiled sun come closer together for warmth against the dews of chilly night. And the wind as it rushes through the tree-tops chants a dirge for the dying leaves and sings a lament for the passing flowers—

> "The wind like one that sighs in pain
> O'er joys that ne'er will bloom again,
> Mourns on the far hillside."

The music of the woods is never more subtle than in autumn; its song is sad, and in its wake it leaves a trail of quivering leaves, that tremble and flutter and fall.

H. H. THOMAS.

Photograph by F. Mason Good, Winchfield.

THE LAST OF THE HOLLYHOCKS.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.
Author of "Wee Tim'rous Beasties," etc.

THE SHREW MICE—II

THE WATER SHREW MOUSE. THE COMMON SHREW MOUSE
THE PYGMY SHREW MOUSE

With Photographs by the Author

THE diet of Shrew Mice in general (the Water Shrew Mouse will be more particularly referred to later) consists largely of insects and mollusca. To this end their teeth have evidently been specialised, the long central incisors forming a pair of roughened forceps, while the molars, whose cutting edges take the form of successive V's or W's, are clearly adapted for crunching hard material. Small snails are a favourite dainty. Sometimes the snail is extracted from his fortress, but the jaws of our two larger species are quite capable of crushing a small snail-shell, and the Shrew Mouse, when roused to bite, bites with a reckless energy. I have, on three occasions, found dead Shrew Mice in my traps who had broken one or more of their central incisors in their frantic efforts to escape. I would impress upon those of my readers who may be interested in trapping small animals alive, that in the case of Common or Water Shrew Mice the traps should be visited at least twice an hour, while to have the chance of securing a live Pygmy, one should be able to sight the trap every ten minutes.

In addition to insects and mollusca, Shrew Mice will readily devour any carrion, fur or feather (a shrimp is a good bait for the Water Shrew Mouse), and probably do much more as scavengers than we are aware of. As a general rule they stand well clear of the ground while feeding, but sometimes in the case of a slippery meal—an earth-worm for instance—they employ their hands to help their teeth. They leave nothing behind which they can bite. An earth-worm is seized by one end, swung from one side of the jaw to the other, and crushed by the right and left molars alternately, growing shorter and shorter until he disappears completely. A fair-sized beetle (the Shrew Mouse is extremely fond of cockroaches also) is caught by the head, and this portion is prudently disposed of first. Small beetles disappear entirely, and the meal, which is consumed at a lightning pace, is followed by a lightning digestion. On occasion Shrew Mice will drink with a curiously bird-like action. The snout describes a small arc in the water, and at the end of its sweep points almost perpendicularly upwards.

I am not satisfied that Shrew Mice have any regular breeding season, and I am inclined to think that their breeding depends on favourable conditions of temperature and food supply. At the same time, from the recurrent mortality amongst them in the spring, one can fancy that at this season, if any, the males are instinctively most warlike. The autumn mortality has never been satisfactorily explained, but the fact that it is not invariable would seem to suggest that weather conditions have much to do with it, either by curtailing the food supply, or by actually affecting the Shrew Mouse's health. I have found captive Shrew Mice extremely sensitive to atmospheric disturbances which do not evidently affect beasties of a more robust constitution.

A duel between Shrew Mice is, as might be expected from their strenuous nature, worth watching. The commencement on both sides is circumspect. The com-

batants advance squeaking with wide-open jaws and snarling muzzles, squirm round each other, jump clear across each other, and at each other. Finally, one or the other gets a hold, often on his

SLEEPING ATTITUDE OF THE PYGMY SHREW MOUSE.

opponent's tail, and here the real business begins. They fasten head to tail and tail to head, and spin as a living ball until the spin itself releases them. After a few seconds' rest, during which they are often lying on their backs squeaking defiance, hostilities recommence, and the rounds presumably continue until one or the other combatant is completely exhausted. I have never seen a duel which terminated fatally. On one occasion I had the privilege of watching one for nearly ten minutes, and when at the end of this time I parted the combatants, neither appeared to have received even a superficial wound.

I fancy, however, that a bloodless encounter of this kind must be exceptional, for I have often handled old males who were as scarred as Chelsea pensioners. One scar which I have frequently met with takes the form of a circular or oval patch on which the hair growth is so short that the grey middle portion of the surrounding fur is plainly visible as a ring round it. It should, perhaps, be mentioned that the "colour" of small animals is largely due to diffused pigment in the *tips* of the hair. For the greater part of its length each individual hair is slate grey or lead-coloured. From scars such as these one must conclude that the Shrew Mouse occasionally has considerable patches of skin torn bodily off him, and wounds of this description are most likely to occur in battles with his own kind.

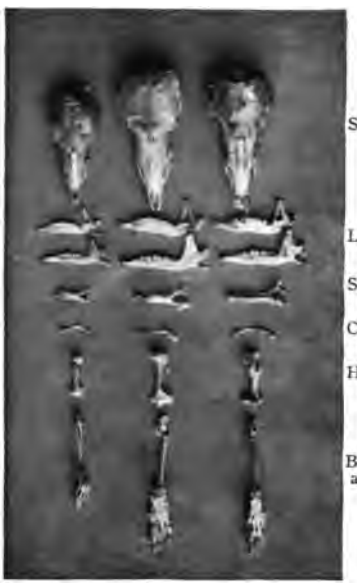
The characteristics which I have so far described are applicable to all three of our British species of Shrew Mice. Before entering into more particular details respecting the Water Shrew Mouse, it may be well to describe the best means of distinguishing the three species. External features are sufficient to distinguish the adults. The body length (nose-tip to root of tail) of the adult Water Shrew Mouse is 80–90 mm.; that of the Common Shrew Mouse 65–75 mm.; that of the Pygmy 45–55 mm. The tail length of the Water Shrew Mouse is about 50 mm.; that of the Common Shrew Mouse about 40 mm.; that of the Pygmy a millimetre or so less. The hind foot of the Water Shrew Mouse measures, exclusive of the claws, about 18 mm.; that of the Common Shrew Mouse 12–13 mm.; that of the Pygmy 11 mm. The latter measurement, as will be seen later, is of great importance.

So far as colour is concerned, all our three species exhibit considerable seasonal variation, and the Common Shrew Mouse is peculiarly liable to freakish patches of

DEAD SPECIMENS OF (*A*) AN IMMATURE COMMON SHREW MOUSE; (*B*) A PYGMY SHREW MOUSE.

The skulls and bones of the fore-limbs of these two specimens are shown on p. 320. The two specimens were approximately equal in size, but the heavier skull of *A* is evident externally.

grey or white, besides being prone to albinism. Generally speaking, however, the Water Shrew Mouse is blue-black in colour; the Common Shrew Mouse a rich warm brown; and the Pygmy a colder brown suffused with a tinge of purple. Both the Water Shrew Mouse and the Common Shrew Mouse occasionally have white fringes on their ears, and there is frequently a cinnamon band on the flanks of the Common Shrew Mouse



SKULLS AND BONES OF THE FORE-LIMBS OF
1. A Pygmy Shrew Mouse.
2. An Immature Common Shrew Mouse.
3. A Mature Common Shrew Mouse.

which I have never found on the Pygmy. The belly of the Water Shrew Mouse is sometimes pure white, with a sharp line of demarcation (the white is often superficially stained by continual contact with muddy surroundings), and sometimes blue-grey. I have taken the two varieties in about equal numbers. The snout of the Water Shrew Mouse is distinctly more blunt than that of the two other species.

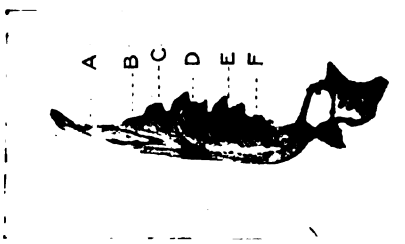
The above external features should suffice to distinguish adults of the three species, while there are certain anatomical differences in the Water Shrew Mouse (he has two teeth less, for example), which make his claim to being a good species indisputable.

When, however, we come to compare the Pygmy, the immature Common Shrew Mouse, and the immature Water Shrew Mouse, our task becomes more difficult, and is complicated by the fact that an immature Water Shrew Mouse presents occasionally a brown-black rather than a blue-black coloration. His muzzle, however, is characteristically blunt, so that our real difficulty commences when we endeavour to distinguish the immature Common Shrew Mouse from the Pygmy. This distinction can only be effected by careful external and internal measurements, for the Pygmy and the immature Common Shrew Mouse are often identical in colour, and so far as all-over body length and tail length are concerned, often identical in size. When, however, we commence to study the external dimensions of the former more carefully, and, carrying our investigation a little further, to take careful measurements of his bones and of his teeth, we find that every bone in his body and every tooth in his head is considerably smaller than the corresponding bone or tooth in an immature Common Shrew Mouse of approximately the same length. The Pygmy is, in fact, a miniature edition of the adult Common Shrew Mouse. He is exquisitely proportioned, and displays none of the legginess and want of balance which is characteristic of a young animal. I am not aware of the existence of any anatomical distinction whatever between the two species, apart from these distinctions of size. It is said that the Pygmy Shrew Mouse is the only member of the family which occurs in Ireland. If this be the case, it would seem as if a mild climate, by favouring an earlier maturity, had influenced his evolution, and it would be interesting to know the mean annual rainfall and temperature of the different portions of the Old World, ranging East as far as Saghalien, from which he has been reported. In this country I have found him wherever I have found the Common Shrew Mouse, and in equal abundance, though, as might be expected, he is more difficult to trap.

So far as breeding, feeding, movement, and general habits are concerned, I have not been able to detect any difference between these two species. The Water Shrew Mouse presents, as might be

A SHREW MOUSE DUEL.

expected, certain peculiarities of his own. Though essentially an aquatic animal, the modifications of his limbs and body to suit an aquatic life are trifling. His feet and tail are perhaps more heavily



VERTICAL SECTION THROUGH LOWER JAW OF WATER SHREW MOUSE.
A, 1st incisor. B, 2nd incisor. C, Premolar. D, E, F, Molars.

haired than those of an adult Common Shrew Mouse, though not more heavily than those of a young Common Shrew Mouse or of a Pygmy. Apart from this, the Water Shrew Mouse might be regarded, externally, as a large blue-black land Shrew Mouse, whose nose had grown fleshy with age, and who had taken to the water as a convenient way of catching fish. I have kept Water Shrew Mice in captivity for long periods, and have had frequent opportunities of watching them in the water, both at large and in captivity, at very close quarters. Like Water Rats, they hate a long immersion, which has the effect of soddening the hair on their back and head. The grey, silvery appearance which the fur of a submerged Water Shrew Mouse presents owing to the entanglement of numerous small air bubbles between the hairs, has been often commented on, but may be observed on any fur-clad animal which dives. The swimming of a Water Shrew Mouse, both on and below the surface, is a quick dog's paddle, all four feet being employed. On the surface the head is slightly raised, and three-quarters of the body are out of water. The tail trails behind, and is apparently quite functionless as regards either swimming or steering. Below the surface the head appears to be stretched forward horizontally.

When scared, the Water Shrew Mouse enters the water anyhow, and I have known one to b·eak his back by jumping on to a stone in a pond which had been drained by pumping operations in the vicinity. In the ordinary way, however, as I have had frequent opportunities of observing, the plunge is a matter of some ceremony. He pauses, with his feet gathered together, and pushes off quietly with his hind legs. He thus keeps his head and back dry. He dives very neatly from the surface, and will do so at the slightest suspicion of danger, though a

1

a, 1st incisor. *b*, 1st incisor. *c*, Position of minute premolar.

2

3

1. SKULL OF THE COMMON SHREW MOUSE.
2. LOWER JAW OF THE WATER SHREW MOUSE.
3. UPPER JAWS OF THE COMMON SHREW MOUSE

A remarkable feature of the skull is the absence of a complete zygomatic arch.

The teeth are remarkable in many respects. In the three British Shrew Mice they are tipped with rich orange. The 1st incisors in both jaws are massive, those of the upper jaw being double-pronged, while those of the lower, before becoming worn, are serrated. The 2nd incisor in the lower jaw is a small tooth, and the 1st premolar in the upper jaw is microscopic.

preliminary scramble over water-weeds is often necessary.

The natural food of the Water Shrew Mouse consists, I think, mainly of mollusca. He eats these very quickly, and with the air of one who knows them. In addition,

he devours all kinds of water insects and crustacea—any aquatic creature, in fact, which is of small dimensions. He catches fish—sticklebacks, minnows and the fry of large species—by the head, carries them ashore, and devours them entire, swinging them from side to side of his jaws, and crunching them with his back teeth, as the Common Shrew Mouse crunches the worm. He appears to enjoy particularly a loach, and I have known him master a small eel after much fuss and splashing in the water.

It was interesting to note that my captive Water Shrew Mice appeared to have some notion of making a food store. In the course of a night they would invariably clear their tank of its living contents, and one would find in the morning seven or eight small fishes piled neatly in some high, dry corner. The Common Shrew Mouse does much the same with cockroaches.

Like the Water Rat, the Water Shrew Mouse prefers his bedding wet. It is possible that this is a survival of some instinct which suggests floating as the easiest method of transporting nest material, but I am inclined to think that these aquatic animals keep their bedding moist in order to lessen and alleviate the attentions of their little friends. Shrew Mice are, by instinct, scrupulously clean, and the portion of their toilet during which they are dressing their fur with one hind foot is most interesting to watch. The hind foot works with such rapidity that it appears a fan-shaped blur, and this blur travels steadily from the animal's ear to the hinder parts of him with a wake of rippling fur in close attendance behind it.

DOUGLAS ENGLISH.

HOW TO KNOW THE TREES GROWING IN BRITAIN

With Notes, descriptive and photographic, for their Identification in all Seasons of the Year

By HENRY IRVING

THE POPLARS

THERE are three kinds of Poplar that particularly claim our attention. These are the Aspen, the White Poplar, and the Black Poplar. In addition we have the tall Lombardy Poplar, which may be regarded as a variety of the Black Poplar; the Grey Poplar, usually held to be a hybrid between the Aspen and the White Poplar; also some less common kinds assimilating, more or less, to the Black Poplar, as the Canadian and the Balsam Poplars. Of these the Aspen and the White Poplar are native trees; the others are of comparatively recent introduction.

Speaking generally, the Poplars may be described as trees with a spreading habit of growth. They are light-loving trees, and therefore are seldom to be met with in our woods, but chiefly upon the borders of these and in the open fields, preferably in the near neighbourhood of water. They have the power of putting up root suckers in abundance, so can reproduce themselves freely without depending so much upon the growth of seedlings.

In *winter* the looseness of their branching is very apparent. In the Black Poplar and its immediate allies, with the exception of the pyramidal Lombardy Poplar, the long, straggling branches and slender, wide-apart twigs produce

an effect that is almost ungainly; and all the more so because of a tendency to grow lop-sided, which is habitual to these trees.

In *spring* they put forth early, long before the leaves appear, a multitude of catkins, long and drooping, which often completely clothe the trees. The Poplars, amongst trees whose fruit-producing flowers are fertilised by the wind's agency, afford the best example of the most advanced methods for its accomplishment. They may be regarded as the standard in this particular towards which the other wind-fertilised trees are approaching. Cross-fertilisation, so essential for the vigour of the race, is here assured by the fact that the pollen-bearing and the fruit-producing flowers are not only grouped in separate catkins, but these catkins are borne on separate trees; so that we have here pollen-bearing trees and fruit-producing trees, separate and distinct. In order that the pollen dust may not be obstructed and wasted by the intervention of foliage, these catkins, growing out from lateral buds on the previous year's shoots, are produced, ripened, and their work accomplished before the leaves begin to unfold. The pollen-bearing catkins are long and pendulous, so loosely composed and hung that they shake out and scatter their pollen dust with the slightest wind. The fruit-producing catkins also, when ready to receive the pollen, are pendulous, quiver and shake, the more readily to intercept it as it is borne past. As a further precaution against failure the pollen-bearing catkins are produced in excessive numbers, so that the air becomes crowded with the floating pollen grains. Haphazard as would seem this method of distribution by fitful agency of wind alone, failure of each tiny fruit-producing flower to secure fertilisation is practically impossible. When their work is done the pollen-bearing catkins fall and litter the ground.

Black Poplar. Aspen. White Poplar.

LEAVES OF THE POPLARS.

In *summer*, by the time the leaves are

ASPENS IN SUMMER-TIME.

ASPEN (DROOPING VARIETY) COMPLETELY COVERED WITH POLLEN-BEARING CATKINS.

fully grown, the fruit ripens. Long tassels of cottony fluff hang pendent for a time, and the seeds, each with its cottony attachment, are gradually carried away by the wind. Eventually the tassels themselves, or what is left of them, fall, making fresh litter below.

The leaves of the Poplars, particularly those of the Aspen and the Black Poplar, rustle and quiver with every breath of wind, suggesting multitudinous merry life, with subtle whisperings, rippling laughter, and frolicsome joy-dance. It must be a dead calm indeed for the interplay of air and sunshine among the quivering Poplar leaves to cease. By this almost perpetual motion these leaves are able to secure increase of light and air, with quickened respiration probably, and possibly an advantage to themselves in ridding their surface of excess of moisture, aiding evaporation and shaking off rain drip.

In *autumn* the leaf changes vary, but mostly to yellow, orange and brown. A peculiarity is noticeable, especially with some trees, in that these autumn tints are at first assumed only partially, producing a somewhat patchy effect. So we see at times a blaze of yellow and gold amidst the elsewhere unchanged green.

TRUNK AND BARK OF THE ASPEN

TWIGS OF ASPEN (ONE WITH CATKIN-BUDS). ALSO FOLIAGE-BUD (ENLARGED)

THE ASPEN

This is the smallest and shortest lived of the Poplars, yet for us it takes pre-eminence among them from the fact that it is undoubtedly a native tree. It is, moreover, the most interesting, and has the pleasantest associations. Its branches are few and slender, with a tendency to become pendulous at the extremities. With this tree the characteristic movement of the leaves is most pronounced and continuous. "To tremble like an Aspen leaf" has become proverbial. An ancient legend pathetically accounts for the Aspen's trembling: it alleges that the Cross was made from its wood, and that the tree ever since has shuddered to remember its part in the great tragedy. Yet to our view the associations of the Aspen are rather those of joyousness, of free, bounding life. Grouped beside some quiet waters, rising over the floating water-lily leaves, and the swaying flags along the margin, the clump of Aspens stands out gracious and tender, yet cheery withal, in the never-ceasing ripple over and around its leafy crowns, whilst the reflected sunshine shimmers and flashes there. Above are twinkling lights, beneath is a tremulous shade.

The *bark* is greenish grey and smooth at first, but roughens as the tree attains maturity. The *twigs* are polished, rounded, yellowish brown in colour. The *resting buds*, arranged spirally on the twigs and pressed, more or less, close up to them, are pointed, glossy and sticky. Their colour is chestnut-brown. The flower buds are larger and stouter. The leaf-scar of the Aspen, and of the Poplars generally, is usually described as semi-lunar, but it is subject to much variation. It has three leaf-traces. The *leaves* are of thin and firm texture, smooth, rounded in shape, with numerous blunt or incurved teeth. The under surface of them is lighter in colour, sometimes greyish. The stalks are long, and are flattened sideways, acting like a piece of tempered watch-spring, maintaining the tremulous motion, and distinctive pendulum-like side-swing, of the leaves. On the suckers which spring up plentifully from the shallow, spreading root system, the leaves are more triangular in shape, are without marginal teeth, and have shorter stalks. As is characteristic of all the Poplars, a single mid-rib passes from the stalk direct to the apex, with branching side-ribs, the lowermost pair of which start immediately from the base as strong secondaries in support of the lower leaf extension. The *catkins* of pollen-bearing and fruit-producing flowers are thickly covered with hairs, rendering them distinctly furry.

WHITE POPLAR IN EARLY SPRING.
Covered with pollen-bearing catkins.

THE WHITE POPLAR, OR ABELE

This tree can also claim to be native with us. It has usually a denser crown than other Poplars, its long branches being more fully furnished with lesser branchings, twigs and foliage. It endures shade better, so may be oftener met with among the trees of the more open parts of the woods. Its leaves are much less mobile than those of the Aspen, and without their side-swing. In the wind they are flung upwards, exposing their white under-surface, giving to the tree

an almost snowy appearance in contrast with the greenery of other trees.

The *bark* is the greenish grey so characteristic of the smooth Poplar bark; but this tint, and the attendant smoothness, are with the White Poplar more pronounced, and longer retained, than with its allies. The lozenge-shaped breathing apertures in its smooth grey surface are numerous and very noticeable. Not until the tree is well matured does the bark at the base commence to roughen. The new shoots and young leaves are covered with a white cottony down, as if smothered with roadside motor-dust. This down easily rubs off. Remains of it are nevertheless found in the *winter twigs*, giving to their natural olive brown colour a greenish grey appearance. The *resting buds* are spirally arranged on the twigs, and are shorter and less pointed than those of the Aspen, not sticky, but covered with cottony down as are the twigs. The catkin buds are larger and more rounded. The *leaves* when mature are thick and tough, deep green and smooth above, with the under surface so thickly crowded with white hairs as to give the appearance of white felt; they are also felt-like to the touch. In shape they are more than usually variable. They may be almost heart-shaped with sinuous outline; or rounded, or long oval, with blunt teeth; or cut into, forming three or five distinct divisions, as is generally the case with those growing on the very numerous suckers. The leaf-stalks are shorter than those of the Aspen, very little flattened, and the leaves are carried more horizontally. The *catkins* of pollen-bearing flowers are very slightly hairy, those of fruit-producing flowers not at all. These last are green in colour.

TRUNK OF WHITE POPLAR.
Showing both smooth and rough bark.

WINTER TWIG AND RESTING BUD (ENLARGED) OF WHITE POPLAR.

THE GREY POPLAR

The Grey Poplar combines more or less the characteristics of the Aspen and the White Poplar. In habit of growth it is very similar to the latter tree, but its twigs and buds are less hairy. Yet its buds are not sticky like those of the Aspen. The leaf-stalks are rather more flattened than those of the White Poplar. The leaves are more like the Aspen's in shape, but lighter in colour and hairy on the under surface, though less so than those of the White Poplar.

THE BLACK POPLAR

This tree is black in the sense only that it is not white, being so named in distinction from the White Poplar. It is

BLACK POPLAR IN WINTER.

LOMBARDY POPLARS IN SUMMER.

a somewhat ungainly tree, awkwardly branched, straggling and lop-sided. It possesses a large crown abundantly clothed with foliage, but has a light and airy appearance from the clear green of its leaves, and their constant swaying motion. In this respect it is characterised by a like tremulousness, with the sustained rustling, of the Aspen. It is not a native tree, but is said to have been introduced into this country about the middle of the eighteenth century.

The *bark* is dark grey, rough from very early in life, becoming extremely so later, with huge irregular swellings that give it a cankered appearance. The *winter twigs* are yellowish brown in colour, slender, cylindrical, hairless and glossy. The *resting buds*, arranged spirally on the twig, are long, tapering to a point, somewhat incurved so as to press against the twig, but with the points free. They are heavily coated with balsam. The *leaves* are variable in form, particularly at the lower end, where they may be rounded or wedge-shaped; otherwise the general outline is triangular with long drawn-out drip-point. Their margins are regularly toothed, and their colour is a light fresh green. A peculiarity which is rare amongst our trees is that these leaves have practically the same tint on both upper and under surfaces. When first put forth their colour is bronze, changing to yellow; and a tree freshly in leaf, seen from a distance, looks as though it were covered with bright yellow blossoms. The leaf-stalks are flattened sideways, as are those of the Aspen. These so bend over that the posture of the leaves suspended from them is vertical, even on the upright shoots. In consequence their upper surface is always presented to view, and their habitual side-swing helps probably to counteract the effect of any shade that may arise from the overlapping of neighbouring leaves. The catkins are more loosely constructed than those of the other Poplars, and are without hairs. They are produced high up in the tree. The pollen-bearing catkins are a brilliant red, the fruit-producing catkins green.

TRUNK AND BARK OF BLACK POPLAR.

WINTER TWIG OF BLACK POPLAR

THE LOMBARDY POPLAR

The *Lombardy Poplar* is generally regarded as a variety of the Black Poplar. Its branches rise almost parallel with the main stem, giving the tree its well-known spire-like form. In nearly all other details it conforms to the habit of the Black Poplar, or with but slight variations. The thick growth of its branches, often from the very base of the trunk, should be noted; and also, when not so concealed, the multiple-pillared aspect of the trunk, as though a number of main stems had coalesced. The trees that grow with us have pollen-bearing catkins only, which cluster about the top of the Lombardy's spire. There are no fruit-producing trees of this species in Britain.

These uplifted spires of the Lombardy Poplars, especially when growing in a line, are notable and impressive. They give a distinctive character to the landscape in which they are found, suggestive of aspiration, but with none of the sombreness which seems to belong to the Roman Cypress, the only other tree with us that takes this form. The Lombardy Poplar is full of strong life, surging upwards like a jet from a water-main, or like a flame. Flame-like it is, in very truth, when autumn has turned its greenery to shining gold, and autumn winds make it quiver, and sway from base to tip, in sweeping curves, deflected, recovering; whilst autumn sunshine makes it glow "as with fire."

THE BALSAM POPLAR.

This tree also conforms closely to the habit of the Black Poplar. The main distinction is in respect of the leaves and twigs. The leaves are coarser in texture, darker green above and very light green, almost grey, below. The leaf-stalks are not flattened. In consequence the leaves are upheld stiffly, and stand out more or less horizontally, while there is no side-swing. The twigs are thicker and stronger, as is needful, to bear the increased weight, together with the greater wind-strain due to the comparative immobility of the leaves. The branches also are more sturdy, and less straggling. The whole aspect, indeed, of the tree is heavier than that of the Black Poplar.

HENRY IRVING.

TRUNK AND BARK OF LOMBARDY POPLAR

Photograph by Prof. R. B. Young.

THE TRACK OF A GLACIER.

LIFE HISTORY OF A MOUNTAIN—II

By J. LOMAS, F.G.S., A.R.C.S.

WE have already passed in review some of the principal agents whose function it is to break up rock masses.

We saw that frost and sun flake off fragments which fall and accumulate near the place where the disintegration takes place. It is evident that if this action continued for a considerable time the rock would become covered with its own waste and would be preserved from further decay.

In places remote from agents of transport this actually happens, but if the *débris* comes within the influence of moving water, ice or air, the fragmental material is carried away and the rocks are left exposed to fresh attacks.

Within broad limits we can say that each tool leaves its own characteristic mark on the rock which it is abrading.

In its action the sea may be compared with a horizontal saw; it undercuts the cliff against which it works, and removes the *débris* as it falls from above. A river cuts like a vertical saw. A country which has been covered by a glacier appears as though it had been gouged and sand-papered in one direction, and scratches are left on the polished rocks showing the same trend as the direction of ice movement.

Sand carried by the wind is usually raised from the ground, and has an upward trend when striking the rock; hence the hollows it drills out are often arched upwards. (See illustration page 248.)

The resulting form of a mountain, however, does not, as a rule, depend on the action of one agent, either of uplift or decay, but rather on the cumulative and selective effects of many.

A most important factor in the control of land forms is the kind of material on which the agents work.

Limestone, for instance, usually weathers into broad uplands. The silence and loneliness of the hills are never so keenly felt as on these bare and treeless heights. The very sound of one's footstep is deadened on treading the soft and velvety grass which covers the scanty soil in places where the solid rock does not come to the surface. Even the valleys are often waterless and silent. A broad view over the upland gives no sign of the deep gorge-like hollows, and in traversing the country we are not aware of their existence until we stand on the very brink of their precipitous slopes. And yet these valleys show features which can only be explained by water action. If we come across a streamlet on a limestone moor and follow it down-stream, we find in many cases it disappears suddenly into a "swallow hole," and flows underground through joints and caves. The valleys represent thecourse of the drainage before it was diverted below the surface.

Chalk is chemically and, in its origin, closely akin to limestone, but it is soft and pulverulent, it is not strongly jointed, and usually weathers into smooth, rolling downs.

Sandstone varies so much in texture and powers of resistance that we sometimes find it in the form of great massive hills like the Brecknocks, and at other times it wears into low flat plains like the plains of Cheshire and Shropshire and the Vale of York.

The Pennine Chain is in large measure composed of sandstones alternating with shales; the former give rise to long scarped hills, and the latter are reduced to deep and fertile valleys.

MATTERHORN WITH ZMUTT GLACIER AND STREAM BELOW.

"The fragmental material is carried away and the rocks are left exposed to fresh attacks."

Slate hills have a tendency to assume a conical form, and where precipices of bare rock stand out on their flanks they show sharp, saw-like edges.

Under normal conditions the above rocks would be laid down in layers arranged horizontally. But we have seen that in mountain-building they become crumpled, contorted and fractured by internal forces, and the work of denudation is profoundly influenced by these conditions.

Internal forces also manifest themselves in the production of great reservoirs of molten rock below the surface. When these communicate with the external

Photograph by G. Bingley, Headingley.

"LIMESTONE USUALLY WEATHERS INTO BROAD UPLANDS."
The edge of the moors from Lastingham.

world they give rise to the phenomena of volcanoes. We meet with many igneous rocks in our islands which prove that our country has been the scene of vigorous volcanic activity at many times and in many places.

We cannot, at the present day, trace in our mountain topography the outlines of volcanic cones, the craters, lava streams and ashes, such as are to be seen in Vesuvius, the Auvergne, and other regions where vulcanism is still at work or only just extinct. Our volcanoes have been so dissected and worn down that only fragments remain, but they are often sufficient to reconstruct in large measure the events which took place when they were active. Antrim and the Inner Hebrides are in great measure built up of great flows of lava piled above each other in places to a height of over two thousand feet.

In the Lake District and in North Wales we have a great development of

"WE ARE NOT AWARE OF THEIR EXISTENCE UNTIL WE STAND ON THE VERY BRINK OF THEIR PRECIPITOUS SLOPES."
The escarpment of Eglwyseg Rocks, Llangollen.

Photograph by G. Bingley, Headingley.

"THE PENNINE RANGE IS IN LARGE MEASURE COMPOSED OF SANDSTONES ALTERNATING WITH SHALES."

Ingleborough. Limestone platform in foreground.

Photograph by G. Bingley, Headingley.

"EVEN THE VALLEYS ARE WATERLESS AND SILENT."

Goredale Beck, Yorkshire.

ejectamenta and lavas of ancient volcanoes. At Castle Head, near Keswick, the actual vent through which the lavas were extruded stands like a monument to the long extinct fires. Where denudation has been active and long destruction has taken place. More frequently, however, they are not so easily destroyed, and remain as outstanding masses when the country rock has been removed.

Snowdon owes its pre-eminence to

Photograph by G. Bingley, Headingley.

"SLATE HILLS HAVE A TENDENCY TO ASSUME A CONICAL FORM."

Swindale Beck and Dufton Pike.

continued, the very heart of the volcano may be exposed. The Tors of Dartmoor, Eskdale, Criffel and Peterhead are only a few out of many which might be cited where a once deep-seated liquid reservoir has been frozen into solid granite and then stripped of the superincumbent strata.

Besides the material thrown out over the surface of the land or spread over the sea floor, volcanic action results in the thrusting of sheets and tongues of liquid rock through the strata, and these, in cooling, become sills and dykes.

Some dykes are more susceptible to decay than the surrounding rocks, and in weathering they have initiated valleys and controlled the courses along which volcanic injections which have reinforced the weaker slates of which it is mainly composed. The Breidden Hills would long ago have merged into the Shropshire plain but for the fact that they were once the seat of volcanic activity. It is in the western borders of our islands, and on the edge of the continental shelf, just before it plunges into the abyss of the Atlantic, that earth movements have shown their greatest development. It has always been held that vulcanism and earth folding were in some manner related to each other, hence it is only natural that in those parts where mountain building has been most active we should also find the greatest display of igneous rocks.

The form of a mountain must also bear

some relation to its age. Some, like the great ranges of the Alps, the Himalayas, the Rockies and the Andes, were uplifted in comparatively recent geological times. They still rear their heads above the snow-line, and though the forces of destruction have carved them into isolated peaks and deeply cleft valleys, they yet retain much of their strength and beauty.

Photograph by G. Bingley, Headingley.

"AND WHERE PRECIPICES OF BARE ROCK STAND OUT ON THEIR FLANKS THEY SHOW SHARP, SAW-LIKE EDGES."
Weathered Slate, Cader Berwyn.

If we turn to the mountains of Wales and the north-west of Scotland we find they are immeasurably older. They have stood against attack through countless ages, and now represent merely the remnants of great ranges which may have rivalled the Alps in their day.

Finally, we meet with the remains of mountains whose life work is done. They have been reduced to featureless plains or low moundy flats, and unless some new manifestation of internal forces uplifts them to give a new lease of activity and life, their careers can be regarded as ended.

Thus far we have considered the history of a mountain from a point of view which deals with the mountain itself and the vicissitudes through which it passes from birth to death.

There is another aspect worthy of a passing consideration — its place in the economy of Nature. Moisture-laden winds blowing up from the sea are condensed on their flanks to form clouds and the fertilising rain. They act as storehouses for water, and give force and substance to streams all through the

Photograph by Tomkinson, Liverpool.

"SNOWDON OWES ITS PRE-EMINENCE TO VOLCANIC INJECTIONS."

seasons. Their waste is spread over the low grounds to renew and enrich the exhausted soil.

If all the mountains were reduced to the level of the sea, cloud and river would cease to exist, the silence of the hills would descend into the plain, and the earth would become stagnant and barren.

The influence of mountains on life is equally important. The varying climates experienced on the earth's surface between the tropics and the poles are reproduced on ascending a lofty mountain. Even near the Equator we get mountains whose crests are covered with perpetual snow and reproduce a climate similar to that of the Arctic regions. Ascending such a mountain, we pass from the region of deciduous trees through a zone of cone-bearing plants to the lonely lichens, and finally we enter conditions where life is impossible.

Mountains have also exerted great and lasting influences on man. In past ages he approached them with fear and awe. They were the seats of the gods, and as the encircling clouds veiled them with mystery he wove legends of heroes and supernatural beings.

Now we make them our playgrounds and seek health and recreation among the snows.

In former times mountains were effectual barriers which prevented communication between the peoples living on opposite sides. Isolation bred peculiarities in customs, language and manners, and races struggling against a stronger invading power found refuge and security in the mountains.

In the wild and unfrequented hills of the west, the Celtic races still preserve their racial characteristics, their language and their ancient customs.

"THE BREIDDEN HILLS WOULD LONG AGO HAVE MERGED INTO THE SHROPSHIRE PLAIN BUT FOR THE FACT THAT THEY WERE ONCE THE SEAT OF VOLCANIC ACTIVITY."

Perhaps we cannot more fitly summarise our brief study of the life history of a mountain than by quoting a short passage from Ruskin's "Modern Painters":

"In order to bring the world into the form which it now bears, it is not mere sculpture that is needed; the mountains could not stand for a day unless they were formed of materials altogether different from those which constitute the lower hills and the surfaces of the valleys. A harder substance had to be prepared for every mountain-chain, yet not so hard but that it might be capable of crumbling down into earth, fit to nourish the Alpine forest and the Alpine flowers; not so hard but that in the midst of the utmost majesty of its enthroned strength there should be seen on it the seal of death, and the writing of the same sentence that had gone forth against the human frame: 'Dust thou art, and unto dust thou shalt return.'"

J. LOMAS.

HOW TO KNOW THE BIRDS

By the REV. MAURICE C. H. BIRD, M.A., M.B.O.U.

KINGFISHER, SWALLOWS AND CLIMBERS

THE brightest gem of British bird-life, the Skyblue Kingfisher, is the first, though in several particulars an aberrant, representative of the *Fissirostres*, the third and last tribe of the perching, or Sparrow-like birds. They obtain their Latin name from the fact that they are wide-gaped—and in the Swallow family especially the mouth is deeply cleft—admitting of wide expansion, in order to enable them the more easily to take their insect prey whilst on the wing. In the Nightjars the wide gape is surrounded with bristles pointing outwards for the entanglement and capture of night-flying moths and beetles. The tropically clad Kingfisher—a rather long-beaked, short-tailed bird, about half as big again as a Sparrow, with azure blue upper parts, dull brick red below, and red brown legs and feet—is one of the pre-eminently unmistakable birds of the waterside; not perhaps really common anywhere, but widely distributed. Shy and retiring in its habits, it haunts for preference slowly flowing streams, from which it secures small fish, water beetles, and crustaceans. It loves to perch motionless upon an overhanging bough (preferably upon a dead branch, as this gives an uninterrupted view), whence it suddenly plunges upon its passing prey, generally returning immediately to its previous resting-place, with the captured fish held crosswise in its beak. The captive, after being mercifully tapped a time or two, perhaps, upon the wood, is swiftly swallowed head first.

When disturbed the Kingfisher darts off with straight and rapid flight;

Photograph by C. Reid, Wishaw, N.B.

KINGFISHER.

Photograph by C. Reid, Wishaw, N.B.
YOUNG SWALLOWS.

generally silently, but sometimes uttering a shrill "seep, seep"—and meanwhile showing off, especially if the sun be shining, its gaudy plumage to great advantage, as it skims the surface of the equally reflective water. Kingfishers move about in the severe weather of autumn and winter, haunting, perforce, the mouths of rivers and estuaries, but, like most birds which pair for life, they return year by year to the same breeding-places, working the self-same beat of water for weeks together. The chosen site is usually a hole made by the bird itself in marsh bank or riverside, but sometimes a disused water-vole's hole is used. I once found a nest in a semi-decayed willow trunk. No real nest is made, and the shiny, white-shelled eggs—with a delicate pink tinge when fresh and unblown—are deposited upon a few disgorged fish bones.

On account of its resplendent feathering the Kingfisher has ever been a favourite object with the taxidermist and milliner, and as both the artificial fly-maker and pisciculturist have likewise—though from opposite reasons—encouraged its slaughter, there is little wonder that this beautiful bird does not more frequently grace our inland waterways. Though a most unlikely attendant at a winter bird-table, I have notes of one that was a daily visitor to a lump of suet when frost and snow precluded a more natural diet.

Four members of the Swallow family are common everywhere; we will take them in order of magnitude—Swift, Swallow, House Martin and Sand Martin. All are summer migrants, the first-named being the last to come and the first to go, whilst the Sand Martin is one of our earliest spring visitors. The Swift, so named from its marvellous power of flight, is practically black—dull, sooty black—all over, with a faint suspicion of white upon the throat; the wings are very long and scythe-like, and the tail is slightly forked. It very seldom settles upon the ground, but feeds and drinks, as do all the Swallow birds, whilst on the wing. All, too, gather nesting materials in the same manner, except, of course, the mud which the Chimney Swallow and House Martin use for their plastered nurseries. All except the Chimney Swallow nest in colonies: the House Martin, or Eave Swallow, attaches its nest to the outside of buildings, the Chimney Swallow always to the inside; the Sand Martin tunnels out holes for itself in the sides of gravel and sand pits and railway cuttings; whilst the Swift makes use of holes in ruins and cliffs and under the slates or tiles of house roofs.

The eggs of all are white with the exception of those of the Swallow proper, which are spotted after the manner of the Tits'. All are double-brooded except the Swift. The Chimney Swallow alone perches on trees, except when old and

young congregate as the autumnal season of migration approaches, when great numbers of Sand Martins roost upon the reeds around our Broads, and all but the Swift delight in resting upon telegraph wires.

The Chimney Swallow alone deserves to be called a song bird, the subdued notes of this species being especially pleasing as summer begins to fail. The House Martin utters a simple twittering, usually from the nest only; the Swift's sole note is a harsh scream, and the Sand Martin is as unobtrusive in language as it is dingy in appearance. All four species are partial to the neighbourhood of water, especially in dull and stormy weather. As to distinctive marks, the Swallow may be distinguished from either of the Martins by its chestnut throat, its uniform glossy steel-blue upper parts, its dirty-white under parts, and its long forked tail. The House Martin has the rump and lower parts pure white, and its feet are also thus feathered. The Sand Martin is of a uniform mouse colour, lighter beneath. The Swift differs from the Swallow in its larger size, swifter flight, and the peculiar narrowness of its outspread wings and general sooty blackness.

The Nightjar takes up the work of keeping the insect hosts in check, which the Swallow tribe relinquish at sunset. It is far more frequently heard than seen. It is protectively coloured; its beautifully vermiculated plumage of ash-grey spotted with black and brown, the white tips to the outer tail feathers, and large white spots on the inner web of the first three wing feathers, render it a lovely object in the hand; when its large eyes, wide gape, surrounded, as I have said, with strong bristles, and curiously pectinated middle toe-nail should be noted. A distinctive habit of the bird is that it always perches lengthwise. This, together with the fact that its legs are comparatively short, render it difficult to locate in the twilight, even when attention is called to its whereabouts by its loud and protracted jarring notes; the bird itself is over ten inches in length. By day it rests on or near the ground, and chiefly frequents commons and waste lands, or woods in which there is not much undergrowth. It is the bird parallel of the Buff-tip Moth in the insect world, and provides a remarkable instance of protective resemblance to the surroundings in which its two lovely, oval, white and lilac-blotched eggs are laid upon the bare or leaf-strewn ground. Whilst toying with one another in their nocturnal flight these birds frequently clap their wings together above the back, after the manner of the Pouter Pigeon, and they also then utter a peculiarly liquid monosyllabic call-note, which sounds something like "queep."

Photograph by J. T. Newman, Berkhampstead.

NIGHTJAR ON NEST.

The Nightjar is our latest summer

Photograph by F. T. Newman, Berkhampstead.
YOUNG GREEN WOODPECKER (THREE WEEKS OLD).

migrant, and is seldom heard before leafy June has arrived, and the Cockchafers are enjoying their drowsy flights.

The Green Woodpecker may be classed with the Nightjar as being more often heard than seen; its loud and resonant laugh or "yaffle" is frequently uttered in spring and autumn. Like the Kingfisher, it is a popular item with taxidermists. Its bright scarlet hood and moustache stripe, black cheeks, white iris, and olive green back, with pale yellow rump and pointed tail feathers, make it an attractive bird for a glass case. But the same yellow-green back is probably, where the balance of Nature is uninterrupted by man, a protective tint which assimilates with the greenery of its natural haunts. In autumn these birds may frequently be noticed on the ground, where they both walk and hop in search of ant-hills. When prying into the cracks and crevices of the bark of trees they progress spirally by a series of jerks or club-footed jumps; both feet and tail are specially developed to assist them in these peculiar movements. The "Woodpecker tapping at the hollow beech tree" is poetically proverbial, but hollow beeches are rare, and the woodland tapping sounds are frequently caused by the Great Tit. Truly marvellous is the power which the latter small bird is able to put forth in this respect, and surprising is the noise which results from so tiny a beak hammering upon a tree trunk in the silence of a still winter's day.

The flight of the Woodpecker is strong and buoyant, though it consists of a series of curves. The nest is made in the bole or large branch of a tree, and is excavated by the bird itself and frequently resorted to year after year. The somewhat pyriform and glossy white-shelled eggs are deposited upon chips of the wood, without any further attempt at nest-making.

Our second most common Scansorial, or climbing bird, is the Wryneck, or Cuckoo's Mate, so called because it and the Cuckoo both arrive here at about the same time in early spring; both Woodpecker and Wryneck have a peculiar foot formation to assist them in their special manner of securing a livelihood, for two toes point forward and two backward. The Wryneck is a much smaller and not nearly so strongly made a bird as the Green Woodpecker; the latter is just over a foot in length, whilst the former only measures a little more than six inches. In locality of nest and colour of eggs they are similar, but the comparative weakness of the beak of the Wryneck disables it from hewing its own nesting hole. In plumage the Wryneck somewhat reminds one of the Nightjar, but it lacks the white wing and tail spots. Like the Nightjar, too, it is more often heard than seen, its "pay, pay, pay" being very penetrating, but its otherwise secretive habits and inconspicuous plumage render it difficult of observation.

The Tree Creeper, still smaller than the Wryneck, is also a regular denizen of the woods, but it resides with us throughout the year. It is a little, dull

brown bird with feeble, plaintive note and mouse-like secretive habits; it works round to the opposite side of the trunk directly one approaches the tree whose bark it is searching for insects, and is often passed by unnoticed. The best way to refind a bird of this species, after one has lost sight of it, is to stand quite still, and give it time to reach the uppermost branches; when it has ascended thus high it will fly down very nearly to the ground level, and begin to hunt again for food from the base of the same or of a neighbouring tree.

The Nuthatch also is well distributed in well-wooded districts; it excels all other British birds in tree-climbing in that it can work its way with equally apparent ease up or down the trunk or boughs of a tree. The special development of the strong and much-curved hind claw is thus justified. Its short tail is not pointed as in the three former species, nor are the feathers thereof stiff, but soft and flexible. It has the undulating flight of the Woodpeckers, and like them is somewhat conspicuously coloured, being pale slaty grey above, with a distinct black eye stripe, and chestnut red under parts; the wing and tail feathers are black, and the outer feathers of the tail have a white spot towards their base. In winter it calls attention to itself by a sharp, though not shrill, call-note—"whit, whit." It nests in holes of trees, the orifice of which it adapts to the size of its body by a stopping of clay or mud. Sometimes, though rarely, it avails itself of a hole in masonry. I saw one such recently in the west wall of a woodland outhouse. The mud plaster was cunningly contrived to match in colour and surface level the adjacent antique bricks and mortar.

Tree Creeper and Nuthatch show their relationship to the Tits in the colour and markings of their eggs. The Common Wren, though now put in a family by itself, was incorporated by Linnæus with the Creepers, and in shape and make it is not very unlike the Nuthatch. Its eggs, too, are white with pink spots, though deposited in a beautifully domed nest of its own construction. The appearance and habits of the bird itself are too well known to require description, nor can it well be confounded with any other of our common birds. It may, however, be news to some to find that the familiar Cuckoo, better known by note and name than sight, is connected with the climbers, as shown by the fact that it possesses what is called a zygodactyl foot, that is, the outer hind toe is capable of being placed at right angles with either the inner or outer front toe. In flight the Cuckoo might be mistaken for a Sparrow Hawk, but its wings are comparatively shorter, its wing flaps are much more incessant,

Photograph by C. Reid, Wishaw, N.B.

WREN AND NEST.

and it has not the rapid flight of the bird of prey. Adult Cuckoos have the upper parts of a pale blue grey, whilst the young birds are brown and black barred, and have a spot of white on the nape — another point in which they mimic the Sparrow Hawk. It is for this mimicry, possibly, they have to suffer the mobbing of harmless small birds, though the resemblance may, on the other hand, protect them from the attacks of their larger relations; for the Cuckoo is a comparatively soft and defenceless bird, in spite of the brave show of fight which a half-fledged young one will make when disturbed. Much has been written upon the peculiar domestic economy of this glad chuckling bird, but there are still questions to be answered concerning the varied colour of its eggs.

MAURICE C. H. BIRD.

Photograph by C. Reid, Wishaw, N.B.

YOUNG CUCKOO.

A GLADE IN THE FOREST.
From the Painting by A. C. Wyatt.

A GLADE IN HYDE PARK NEAR THE MAGAZINE.

NATURE "IN TOWN"

HYDE PARK AND KENSINGTON GARDENS

By ARTHUR SCAMMELL

HYDE PARK may be regarded as the meeting-place of two worlds: a scene wherein the drama of eager human life goes on side by side with the slow calm processes of Nature.

The human picture is indeed a full one. High life and low life; kings following the chase, and outlaws hiding from justice; royal cavalcades and sorry processions to Tyburn; rank and fashion in daily parade, over against demonstrations of the unemployed; luxury in a royal palace, and tired destitution in uneasy slumber upon the park benches; loyalty doffing to the king, whilst over there the demagogue bellows upon his tub; Rotten Row upon the one hand, upon the other the Reformers' Tree and the re-erected Hyde Park railings: and between these extremes the constant coming and going of the multitude of decent citizens; not making history perhaps, but certainly making love; taking the air with their wives and children or, at the least, exercising their dogs. An epitome of London is Hyde Park—a pageant of English history.

For the Nature side of the picture we have six hundred and thirty-six acres of gardens, pasture, lake, and plantation, wherein five or six hundred varieties of trees and shrubs are growing, mostly

under quite natural conditions; where for the greater part of the year two flocks of sheep are grazed; where rabbits live in a warren, and water-voles enjoy their native element; where numerous singing birds, with jackdaws, crows, and doves, live and breed, whilst land and water are frequently visited by strange and rare

A LONDON PASTURE: HYDE PARK.

species; where bees and butterflies hover over the flowers, the dragon-fly gleams in the sunshine, and bats and moths flit abroad at dusk.

I suppose no trees in the world have seen quite so much of human history as the oldest of the elms in Hyde Park. Take that scattered party of veterans—remnants doubtless of an army—dotted about the neighbourhood of the Royal Humane Society's house by the Serpentine. With worn and hollowed trunks, dismembered again and again by the hand of man and the ravages of tempests, they still make a brave show of summer green, and live on; the dignity and the feebleness of age alike protected by the decent iron railing. They live, all but one; he leans there, lifeless but not fallen, stayed with doubtful compassion by iron crutches; like dead Cæsar, with his mantle of ivy drawn over his head.

Hard by here, two centuries ago and more, was the famous Ring—a much contracted Rotten Row of the time—where the coaches of the great used to drive round and round that the world of rank and fashion might see and be seen. Mr. Pepys' coach amongst them, varnished to "make it more and more yellow, with the horses' tails tied in red ribbons, the standards gilt, and green reines, so that people did mightily look upon us."

"My Lord Protector's coach, too, with his three daughters all in green," hunted by the multitude of sight-seers. My Lord Protector himself, essaying to drive his own coach, and lashing the horses furiously, so that he was run away with, and violently thrown; his pistol going off in his pocket. The restored Court in laces and periwigs. Hanoverians and Jacobites. The plague-stricken camp of

The Avenue.

Near the Serpentine Bridge.

IN KENSINGTON GARDENS.

1665. Refugees from the Great Fire; duels, coronations, Crystal Palace—the old elms have seen it all. Well may they wear a grave and reverend look, as those

"That have kept watch o'er man's mortality."

But in truth the trees are not at all concerned with man and his doings; bourne only known as a brook which ran across to Westminster under Knight's Bridge, feeding the ponds on its way. Hyde Park, therefore, was quite in the country; an enclosed piece of the County of Middlesex.

Middlesex, the homeliest of the home counties, where no one looks to be excited

THE WATER GARDEN: HYDE PARK.

their fealty is to the great god Pan; their business to draw by rootlet and leaf the meat and drink they need from the earth and air. For the life of vegetation has the greater strength of slowness and endurance; the earth was green before we came upon it, and green will be the grave of the last man. And it is a sense of this dominance of Nature which causes some of us in Hyde Park to-day to get away as far as may be from the ephemeral people, and sit in solitude upon the carpet of grass that will never wear out, and look up into the everlasting roof of the branches.

In Mr. Pepys' day, Kensington and Bayswater were small villages, and West- by fine scenery; but where trees are many, and the lanes long and quiet; where the colouring is always subdued and restful; dark and cool in summer, and in winter still soft and verdant; the paradise of the haymaker, the land of the meadow and the elm tree.

It seems quite in the natural order, therefore, to find the elm the dominant tree in Hyde Park. The tree of the homestead and the hedgerow, never of the forest: of the country, but not of the wild; not quite a city tree, but never far from human neighbourhood. The silver birch needs the mountain slope and the brook for environment, the beech the chalk hills, whilst the oak should

THE DELL: HYDE PARK

"muffle round its knees in fern" far in the depths of the forest. And the call of these wilder trees always seems to be "up and away," but the elm says "it is good to be here."

For the well-being of the trees, as well as for the general safety, it is necessary often to remove large limbs from the older timber, and in this the elm suffers less than oaks and other trees, which extend their branches horizontally (for naturally it is the horizontal branches which are most commonly sacrificed). If allowed an ample space, the elm can make as great a spread as another; but its chief glory is in its height; the elm is essentially a soaring tree, and its noblest branches strike always at the sky; only leave it its stature and the dignity of the tree will be maintained.

Others of the elder brethren have not fared so well as the elms in the battle against time and all the other ills that trees are heir to. The sweet chestnuts which Caroline, Queen of George II., planted when she filched land from Hyde Park to add to her gardens of Kensington Palace, are scarcely more than the relics of trees; picturesque as noble ruins always are, and still with much of strength in their old trunks, and vivid life gleaming in the clean serrated leaves: still "they bring forth fruit in old age," though perhaps one should not expect ripeness and edibility from those prickly burrs.

Hollow trunks, ridged and twisted bark, with stumps for limbs and branches dead and bare, how strong and how pleasant the contrast between these and the younger trees planted amongst them; slender soaring limes, feathery ashes, and stripling silver birches. Crabbed age and youth happily living together.

The oaks probably never made a great show here. They cannot learn, one thinks, to love the London clay, and it is certain they will not abide the London smoke. Here and there may be found amongst the younger oaks healthy and well developed trees, and one may yet sit beneath the crooked horizontal boughs and see the sky above fretted by the lovely pattern of the oak leaf. We of to-day may do this, but, unless we learn to purge our air from smoke and a hundred noxious gases, our children's children will look in vain for a London oak.

The sward in the less frequented parts of the Park is particularly pleasant with a warm and comfortable kind of pleasantness; the great diversity of the grasses, and the prevalence of agreeable "weeds," give it the appearance and firmness of old and mellowed pasture—which indeed it is. It is not too much to suppose that some of this may be actually virgin turf, the very sward that was trodden and cropped by the deer of the old forests of Middlesex.

Moreover, it is quite clear that the Kensington Garden fairies, at one time grown rare and even supposed by many to have become extinct, but which in these latter times have been fully rehabilitated by Mr. Barrie and Mr. Arthur Rackham, dance upon the grass a good deal of moonlight nights, for here in evidence are many of "those green-sour ringlets, whereof the ewe bites not."

A city park, however pleasant, is not the country; the best it can do is to suggest the country, and it is the wonder of Hyde Park that, shut in by the countless streets and buildings of London, it does this so well.

In the evening of a showery day in autumn (showers clear the air—and the ground—the populace not loving rain) one may go into the Park and scent the grateful moisture, and the odour of fallen leaves, and see boughs and sky reflected in little pools of clean rain water. The contemplative visitor will naturally drift to the quietest part of Kensington Gardens, and look toward the west, where the sun is going down amongst stormy broken clouds; he will admire once more the alchemy which turns London smoke into curtains of dusky gold—gold mingled with fire. And when the colour dies out of the sky, and the shadows deepen under the trees, there will steal into the mind a sense of the shadows which the same evening hour is spreading in the hollows of quiet hills all over England. And the breeze which murmurs in the planes overhead will sing, in ears unhearing for the time the sound of London's traffic, the song of the forest and the mountain pine.

When one thinks how many lives of

town dwellers are enriched by hours passed thus, it is possible in part to realise the magnitude of the debt London owes to this beautiful pleasure ground.

If I had been a man—such an one, say, as George Gissing—an inveterate lover of the country, yet compelled by unkind destiny to pass, in poverty and toil, the best part of life in London: if the changing seasons had been scarcely known except by the increase of heat or cold; if the snow had never been to me a pure thing, but only seen smirched on the roof and fouled in the gutter; if I had the bitter knowledge that my natural heritage—insufficient at the best—of summer days had been lost, and the iron had deeply entered into my soul—then, if I were, like Charles Lamb, suddenly to receive my manumission and find myself at last free to fly away and be at rest, I would spend my last evening of city life in Hyde Park. I would traverse the open spaces whence the houses are only to be seen in glimpses between green boughs; I would walk the long avenues, and let my feet rustle amongst the dead leaves; I would note the harmony of clustered sheep beneath the trees, and regard with mild reflected sympathy the whispering lovers; and when the day had come to an end, I would turn and speed away to lose myself in the heart of the west country.

KENSINGTON GARDENS: NEAR VICTORIA GATE.

Thus would I forgive the city for my long imprisonment; so would I say farewell to London; through this green vista should it ever after be seen; and when memory would recall the sorry picture of mean districts, over against it I would set the grandeur of the Broad Walk. The thought of the unclean turmoil of streets should be softened by recollection of that tiny spot of evening calm, the Dell; and even that darkest cloud of all, the misery of the poor in their squalid homes, would be lightened by the memory of the children at play, and lovers in their happiness in Hyde Park.

ARTHUR SCAMMELL.

THE WEASEL.

HOW TO KNOW THE WILD ANIMALS

By DOUGLAS ENGLISH, B.A., F.R.P.S.
Author of "Wee Tim'rous Beasties," "Beasties Courageous," etc.

THE STOAT AND WEASEL

With Photographs by the Author

THE subjects of my next two articles, the British Weasels, are animals belonging to an entirely different order, and displaying entirely different characteristics to those we have already considered. The Order Carnivora embraces, on the one hand, some of the most bloodthirsty and untameable animals known, on the other, the completely domesticated dog and the semi-domesticated cat. It is not a little curious that primeval man should have gone to this order for his choice of home companions. One would have thought that he would have turned more naturally to the apes. He may have done so and found the propinquity too embarrassing. Be this as it may, there seems little doubt that the domestication of the dog was due to man's discovery that an intelligent hunting carnivore was well worth its keep; while the later adoption of pussy into a somewhat elastic home-circle may have had its origin in the rescue from the pack of some helpless kitten, whose prettiness led to its being retained as a plaything for the children, and whose mouse-killing instinct was quickly appreciated in an

age which was learning to husband grain.

As the name implies, the Carnivora are essentially flesh eaters, and it will be soon realised by any one who keeps them in captivity, that it is on this flesh-eating habit, which is at once predatory and combative, that their ferocity under natural conditions very largely depends. The matter can easily be tested by modifying the diet of small Carnivora kept under conditions which allow them scope for unlimited exercise. If allowed to kill their own provender, or fed exclusively on raw meat, they will almost always be morose, uncertain, and snappy; while if they can be coaxed (I use the word advisedly) to take a mixed diet of cooked meat, milk and vegetables, their ferocity will diminish, and they will often display unexpected and, owing to their intelligence, peculiarly winning forms of affection towards their keepers.

The taste of warm blood seems to have an extraordinarily stimulating effect on the nervous organism of a carnivore, and the phenomenon of "killing for killing's sake" (an extremely remarkable one in a wild animal), may be ascribed to this stimulating effect, heightened by irritation at the disturbance of a hard-won meal.

A Stoat in a hen-house, for example, would probably content himself with a single victim, if it were not for the outcry of the victim's relatives.

The Weasel family (we have four species in Great Britain: the Stoat, Weasel, Polecat and Marten) has always attracted considerable attention from humanity, partly on æsthetic, partly on commercial grounds. Most ladies to whom I have shown a Marten in full winter pelage have betrayed, even if they have not openly expressed, the opinion that his fur might be better displayed; while the annals of trapping in northern latitudes afford remarkable evidence of the lengths to which human endurance can be driven to gratify the demands of fashion. The word "ermine" has acquired a regal significance; it is inseparable from a description of State robes; it becomes "judicial" in token of its connection with the Crown; yet "ermine" is no more than Stoat's fur. The Stoat is a small animal, and it takes many of him to make a capacious wrapping. How many, the reader can judge from the fact that each black tag on the white of an ermine robe is, or should be, the tip of a Stoat's tail. Fashion has decreed that, to be valuable, a Stoat's fur must be white, and, since this change to whiteness is a seasonal one, and does not regularly occur in temperate latitudes (though even in the south of England white Stoats are less uncommon than might be supposed), the value of "ermine," or rather that part of the value which is not fictitious, is due to the hard conditions under which the trappers have to work.

The seasonal whitening which occurs in several northern animals at the approach of winter, is a remarkable phenomenon. To begin with, it should perhaps be stated that most animals which have to compete with marked climatic changes of temperature moult to a greater or less extent during the summer months, and produce a fresh crop to meet the severity of winter. A question which has excited some controversy is whether, in cases where the winter change includes a loss of pigment, there is a gradual whitening of brown hairs or a new growth of white hairs. It is generally conceded that the colour of hair, as a whole, is due to pigment contained in the cells of which the tip of each particular hair is composed. Metchnikoff has shown us that the whitening of hair, which is an accompaniment of old age, is due to the consumption of this pigment by phagocytes, who, after accomplishing their unholy purpose, retire glutted under the skin, or quit the body altogether. This leaves the pigment cells empty, and the reflection of scattered light (as opposed to its previous absorption), partly from the surface of the hairs, and partly from minute bubbles of gas in their interstices, gives the effect of whiteness which is familiar in snow or powdered ice. In the same way the whiteness in the Stoat's winter pelage is due to absence of pigment in the individual hairs. The great difference, however, between age whitening and seasonal whitening lies in the fact that, whereas in the former the power of reproducing pigment is lost, in the latter it is merely suspended.

In summer pelage the Stoat has little

white fur about him. The lighter portions of his body have a primrose, even a sulphur tint. The seasonal whitening proceeds from his belly upwards, the last portions to change being in order, the ridge of his back, the crown of his head, and a brown ring round each eye.* It is noticeable that these portions have little, if any, fat underlying them, and it has been suggested that the vital energy

YOUNG WEASEL.
Compare with the adult animal in similar attitude on the opposite page.

which in summer is expended in the formation of pigment, is in winter diverted to the formation of fat, or to the production of a thicker growth of unpigmented fur.

The change, that is, is due to a sluggish metabolism, with deficient oxidation and consequent fatty degeneration—almost a case of anæmia. This necessitates the assumption that the pigment is directly derived from the colouring matter of the blood. In the light of modern research, it seems more reasonable to suppose that the effect of cold, and perhaps gloom, on animals which whiten in winter, is little more than skin-deep. Pigmentation is now supposed to be due to the act of a ferment on a proteid (tyrosin) in the epidermal cells, and, if this supposition be correct, it is not improbable that a climatic change to cold and gloomy conditions would check the fermentation. Whether this would result in a blanching of the existent hair, or a growth of new white hair, would depend on the more or less forward condition of the fur when sunless cold set in, and on the degree and continuity of the sunless cold to which the skin beneath it was exposed. I have had no experience of Stoats whitening in captivity, but so far as the moult is concerned I have found that all our Weasels shed their coats copiously in May and June, and that from about that time the winter coat is gradually acquired. I have not been able to distinguish any marked growth of fresh hair in late autumn.

The Stoat and Weasel are the most familiar of our Mustelines, and I propose in this first instalment of my article to confine myself to them. To begin with, I would invite the reader's attention to their beauty of form, and I have little doubt that this beauty will come to many as a surprise. The glimpses which one obtains of a Stoat, or Weasel, at large are generally of but momentary duration, while the conception to be derived from dead specimens, whether gibbeted on the keeper's tree or mounted in the museum, is seldom even approximate to the truth. It is due, nevertheless, to such a conception that the peculiarly sinuous, lithe body, the graceful mobile neck, the short but finely balanced limbs, have been described as "vermiform"; that the animals themselves have been contemptuously and ignorantly classed as vermin; and that the very words Stoat and Weasel have gradually acquired a sinister meaning. From a predatory point of view there is little to choose between the Stoat and his human enemies; while from a purely sporting point of view the balance is somewhat in favour of the Stoat. "Stoat," or "Stot" in its original meaning, almost certainly denotes "stout" or "bold," while "Weasel," which is found in most Germanic languages, may possibly have the same origin as the Swabian *wuseln*, which means "to skip about."

Playfulness is a marked characteristic of both animals. I have watched a Weasel skipping backwards and forwards across a water-course, for no other reason which

*O. V. Aplin, *Zoologist*, May, 1898.

A WEASEL WITH HIS NECK FULLY EXTENDED.

I could discover but the mere joy of living. In countries where the cult of game has not yet reached the commercial stage, the names of the Weasel are mostly affectionate diminutives. The Italian *donnola* for example, meaning the "little lady"; the Spanish *comadreja*, "godmother"; the Bavarian *schönthierlein*, "pretty beastie";* while our own provincial "fairy" shows that our forbears regarded the little creature with an affection which was based, not only on its playfulness and elegance, but also on a common-sense view of its utility.

Apart from their relative sizes it is easy to distinguish between Stoat and Weasel by their tails. In the Stoat the tail is long, and terminates in a bushy black tuft, which never whitens in winter. In the Weasel the tail is short, and displays throughout its length the russet colour of the animal's back. Both animals show such variations in size (the males are always the larger) that it is difficult to assign to them definite dimensions. The extreme all-over measurements I have encountered are: Male Stoat, 18 inches; Female Weasel, 8 inches. In the Stoat the tail is rather less than half the length of the head and body. In the Weasel it is rather more than a quarter. I have never found any primrose or sulphur tinge on the under surface of the latter, and so far as the distribution of brown and white on the feet and lips is concerned, I have never found two animals of either species identical. Examples of albinism in Weasels are by no means infrequent, but this is, of course, a different matter to seasonal change, and I know of no instance of the latter occurring in this country. Both animals are well whiskered, and have, in addition, a few stout *vibrissæ* on the elbow joint, which no doubt are of service to them when groping their way after dark. Though I have not been able to determine by measurements that the Weasel's neck is proportionately longer than the Stoat's, the appearance of the former,

ADULT WEASEL.

* E. von Martens, "*Ueber Thiernamen.*"

when alive, certainly gives one that impression. This may, in part, be due to the frequency with which he flings it back or swings the whole stretch of it at right angles to his body.

There is considerable resemblance in the habits of the two species. The evidence that families of them hunt in packs, and that they hunt mainly by scent, is incontestable. Packs of both species have been known to attack man. Indeed few wild animals are normally so fearless, though I have known individuals the reverse. I remember once meeting a Stoat sauntering down one of the gravel walks of my home. I waited for him to pass. Without changing his pace, he came, with his head held high and his tail waving from side to side, to within a yard of my feet. He had a good look up at me, stamped impatiently with one foot, and made some offensive remark. Then he walked away (I can hardly call it retreating) with the same dignity as that with which he had approached. Once only he paused to look back over his shoulder, show his teeth, and make the same remark. I have known another come into an out-house in which I was lying up to shoot sparrows, and on discovering me, set his back against the wall and scream until I humoured him by withdrawing. I have known another chivying sparrows on a main road, on either side of which were fields crowded with fruit-pickers. This was about 3 p.m. on a blazing July day. I was fortunate enough to sight the Stoat about fifty yards off, and was able to get a clear view of his proceedings through a field glass. Amusement rather than food was his object. He would wait until a covey of sparrows were busily engaged in their usual occupation, creep along the cover at the roadside, and leap with a beautiful swing into the midst of them. Up would fly the sparrows, to settle down a few yards further off. The Stoat would repeat the manœuvre from the opposite side of the road. Seven times he put the sparrows up, four times by jumping into the midst of them, three times by running through them. On the latter occasions the nonchalance of the birds was amazing. When he jumped they flew up in a body as one would expect, but, when he ran through them, they merely made way for him with a hop and a flutter, and were back to their occupation almost before he had reached the farther side. The impression one gained was that the Stoat was using the sparrows as playthings, and was

SIDE VIEW OF A STOAT'S SKULL.

Showing the typical dentition in a carnivore. Points of interest are the extremely large size of the canines (D), the "killing" teeth, and the two carnassials (C), in the upper jaw the 4th premolar, and in the lower jaw the 1st molar. These come together like a pair of shears, the upper being outermost. The teeth in front of these have cutting edges, those behind are rounded.

UNDER SURFACE OF A WEASEL'S SKULL.

In this picture the articulation of the lower jaws with the skull should be noticed. This articulation, which is typical of carnivorous animals, is formed by a transverse development of the condyles (C) fitting very closely to the glenoid cavities (G). The power of the jaw is thereby greatly increased, and the possibility of any side play which might lead to dislocation correspondingly diminished.

YOUNG WEASELS.

making them jump merely for the fun of it.

The question whether Stoats and Weasels have the power of fascinating small birds by gambolling before them is of interest by reason of the number of observers who honestly believe that they have seen this power exercised. For my own part I have never had such good fortune. I have seen both Stoats and Weasels "mobbed" by small birds. On one occasion I remember getting close to a "mobbing" on a foggy October morning. A Stoat was up a walnut tree some twelve feet from the ground, while a heterogeneous pack of small birds were behaving in much the same way as they will in the presence of an owl. I had a good view of the Stoat, who listened to their hysterical twitters with complete indifference. "It never troubles a wolfe how many the sheepe be."

This Stoat, on sighting me, leapt straight to the ground and vanished, for which retreat a peculiarly arrogant-looking robin appeared to take credit.

I have seen a Weasel actually playing while small birds were mobbing him, and he again showed complete indifference to his surroundings.

Given an excited assemblage of small birds engaged in mobbing a Stoat or Weasel, who treats them with contempt, it is likely enough that an individual may occasionally overreach himself and fall a victim to his own imprudence, not to say impudence. This, however, can hardly be credited to "fascination,"

THE STOAT.

The head in this picture should be compared with that of the Weasel at the commencement of the article.

nor need the partial paralysis, which seizes on hare or rabbit when Stoat or Weasel is close upon them, be attributed to some occult power exercised by the pursuer. It is more likely to be the result of terror and exhaustion combined. I have seen a rabbit drag itself through the hedge-row and drop dead in the middle of the road without a sound. I have seen another stop short in mid-field, and heard it scream until the Stoat reached it. I have seen a Stoat leap on a rabbit which was sitting motionless with closed eyes stark in the open. In connection with all these cases it must be remembered that probably they are the *finish* of the tragedy. It must be a grim business from the start. One can fancy

the rabbit's instinctive sense of danger; his rush to the burrow; his feeling, call it conscious or unconscious, as you please, that the pursuit is not shaken off; his rush to the open once more; back to the burrow; back to the open; to the pursue that quarry with relentless insistence, and the hare or rabbit, as the case may be, is cognisant, not of the pursuer, but simply of being pursued.

A Stoat's or a Weasel's larder is usually a mixed one, and bears ample evidence of

THE STOAT.
The picture shows a frequent but momentary attitude which he adopts in stalking.

field; to the thicket; to the haystack; anywhere; till at the last his limbs refuse their office. But for such conditions it is hardly likely that the larger animal would be mastered. The disparity of size between Stoat and hare, or Weasel and rabbit is very great, and instance after instance has been recorded of a doe-rabbit with young turning the tables by vigorously pursuing the Stoat or Weasel, while a double-barrelled kick from a leaping buck-rabbit would assuredly break the back of either of our small Mustelines. It would seem as if Stoats or Weasels instinctively adopted wearing down tactics before attempting the *coup-de-grâce*.

Once they have set themselves to hunt, and selected their quarry, they his hunting skill. One such which I excavated at the roots of a hawthorn contained three blackbirds (doubtless caught roosting above), a young rat, several meadow-mice, and two mummied frogs. I secured the owner of this, as dainty a fairy as I have yet encountered, a bare six inches from nose-tip to root of tail, and small all over. In West Kent these diminutive (female) Weasels are known as "kines," and I fancy that this word occurs in other parts of the country, the vowel being modified to suit the dialect.

I have no experience of young Stoats, my only acquaintance with them having been a dim uncertain view in the recesses of a hollow tree. During the quarter of an hour I was absent in search of an imple-

THE STOAT.

ment with which to enlarge the entrance, the mother very properly removed them. My experience of young Weasels is more definite. In May, 1904, I secured a litter of five during the threshing of an oat-stack. They were of the same colour as adults, well-furred, but blind. Four days after capture their eyes opened. Their note was a high whimper, and could be exactly imitated by rubbing a moistened finger on glass. They quickly took to sparrow-meat, and, when I had had them a fortnight, their whimper ceased, and they developed the power of "hissing." This always occurred under cover. A Weasel under cover, who suspects mischief, arches his back and gathers all four feet beneath him. He may or may not hiss. His "yap," the ultimatum, is accompanied by a lightning lunge, and recovery of the head, neck, shoulders and fore-part of the body. It is impossible to disregard the serpentine character of this attack. Personally I could never face it without flinching. Apart from this muscular adaptation to quick forward movement, the anterior portion of a Weasel's body admits of an extraordinary amount of lateral play. A favourite exercise of my Weasels, when full-grown, was to swing the fore-parts of themselves from side to side through something like a right angle, at a rate which I timed on several occasions of 150 strokes a minute. Another example of this body flexibility was seen when a pair quarrelled. Before one got a grip of the other it was impossible to follow the inextricable confusion of their bodies. I never saw the throat grip, which presumably was intended, but on several occasions I saw one fasten on the other's nose. The victim's procedure was always the same. He flung his hind-quarters off the ground and twisted completely round. The aggressor of necessity followed suit, and the pair formed an animated spiral, the revolution of one body being a shade in front of that of the other. I have counted twenty-three such revolutions in succession.

In spite of the evidence of Weasels hunting in packs, to which I have already referred, I should judge the adult Weasel to be normally a solitary animal. In the case of a pair of my captives, each had his own corner of the cage, which he defended *vi et armis* against his fellow. Frequently they fought, and in the end one killed the other; yet at times they played like puppies. The game was hide-and-seek, one taking cover, waiting till the other approached, yapping at him, and, if he retreated, pursuing him round and round the cage and up and down its wire-netting side. As in the case of dogs, it was easy to distinguish these mock combats from the real thing. The Weasel has two characteristic methods of running. In one he keeps his body very low and straight. In the other he progresses by a series of bounds, and at the top of each bound his body is strongly arched with all four feet together beneath him. He frequently adopts this dancing method when he has to carry a small bird, or mouse, over rough ground.

DOUGLAS ENGLISH.

HOW TO KNOW THE BIRDS

By the REV. MAURICE C. H. BIRD, M.A., M.B.O.U.

THE GALLINACEOUS BIRDS

WE have now arrived at the fourth great order in Linnæus's classification, which contains the gallinaceous or fowl-like birds. The Pigeons head the list, and we have four British representatives of this family — Wood Pigeon, Stock Dove, Rock Dove and Turtle Dove. The three former are residents, but the Wood Pigeon especially has its numbers greatly recruited in winter by migrants from more northern and eastern climes. The crooning Turtle Dove occurs only as a summer migrant. It is rather late in arriving, for it seldom appears before the first week in May. Its small size at once distinguishes it from its congeners, and its mournful note—"tur-tur," from which both its English and Latin specific names are derived—is somewhat suggestive of the twilight music of the toads. In flight this Dove may be recognised by its fan-shaped tail, which, at close quarters, shows white at the tips of the semi-expanded feathers. As it is especially fond of the seed of the red and white campions and corn-cockle, it may be counted as a farmer's friend.

Photograph by C. Reid, Wishaw, N.B.

WOOD PIGEON'S NEST.

The Wood Pigeon is generally known as the Ring Dove, in consequence of the conspicuous white patches on either side of its neck, which apparently form a complete circle whilst the bird is on the wing;

these, together with the white wing bars, mark it off distinctly from the smaller Rock and Stock Dove. During the prolonged breeding season—from April to September inclusive—the natural shyness

All four species of Doves lay two eggs only, and both sexes take equal shares in incubation. The eggs of all are pure white, somewhat elongated, and equally pointed at either end. The Turtle and

Photograph by J. T. Newman, Berkhampstead.

YOUNG PARTRIDGES.

of the wary Wood Pigeon wears off. In the summer, too, the dense tree foliage prevents approaching man from being so easily seen by the amber-eyed Cushat, whose peculiar nuptial flight—consisting of a series of dives, the bird alternately rising and falling voluptuously through the air—may then frequently be witnessed. The bird is much persecuted in consequence of the great damage done by flocks of this voracious feeder to ripening grain, swede tops, and young clover plants.

The only redeeming features about the Wood Pigeon from an economic point of view, that I am aware of, are, that it devours the very astringent seed of the buttercup, a troublesome weed in permanent pasture, and that the abundant meat on the bird's breast—needful muscles to work its loud clapping wings—renders it an acceptable adjunct to the dinner table.

Ring Doves deposit theirs upon a cleverly, though apparently carelessly, and widely, woven platform of sticks, placed in trees or bushes at varied altitudes, according to the privacy or otherwise of the surroundings. The Stock Dove breeds in holes of trees and ruins, and also in deserted rabbit-burrows, whilst the rarer Rock Dove, as its name suggests, inhabits rocky coast land caves, never even condescending to perch on trees. The chief distinctive marks in the two similar-sized Doves last mentioned are as follows—the Rock Dove has the rump, as well as the back, blue, and one black wing bar only, whilst the Stock Dove has a white rump and two black alar bars.

The foreign Pheasant, probably introduced by the Romans, has been with us long enough to win a place upon the British list, and even without the aid of artificial rearing it sufficiently maintains

PHEASANTS.

Photograph by C. Reid, Wishaw, N.B.

its numbers, in broken country, to be classed amongst the common residents. If, however, the game laws were repealed it is probable that its size and tastiness would soon tend to its extinction, in spite of its hardiness, and the marvellous manner in which the very highly coloured male bird can manage to escape destruction in unpreserved districts. The latter is the more extraordinary in view of the self-advertisement of his whereabouts during the breeding season by his constant crowing, and as frequent wing clapping. The latter vibrating sound is made after, instead of previous to, the crow, as is the custom of our barn-door Chanticleer.

Photograph by C. Reid, Wishaw, N.B.

RED GROUSE.

Although the Red Grouse is absent from most counties in the United Kingdom, it would be unfair to omit any mention here of our only real British bird, in the exclusive sense of the term. Nowhere else in the world is he to be found wild, and is it not a great annual question, as to whether or no Parliament should rise in time to watch and help to stay the bird's flurried flight upon the far-famed "twelfth"? The larger species of Grouse, the Black Cock and Grey Hen, as the sexes are severally called, is perhaps more widely spread throughout the kingdom, but nowhere in such numbers, as the more protectively coloured bird of the heather already mentioned. The latter is more of a lowland bird than the Red Grouse, just as the winter white Ptarmigan is a constant denizen of the highest mountain tops. During the summer season the latter bird is granite-coloured and beautifully vermiculated, and equally suitably clad to escape observation as in the winter. Its plumage assimilates closely with the prevailing hues of its surroundings, which are, when the snow has melted, sparsely covered with lichen-grey vegetation and the brown-green tips of the young heather, upon which each species of Grouse delights to feed.

The difference in general plumage between the English or Grey Partridge, and the so-called French, or red-legged bird, is so distinct that there is no need to say more than that the latter has a uniform reddish brown back, and its wings are flanked with very pale lilac-coloured feathers, which are widely barred with deep chocolate. The upper part of the native species is beautifully decorated with various shades of brown, and the neck and chest are grey with black ver-

miculations. The deep chestnut horse-shoe on the breast of the adult bird must not be depended upon as a sure sexual distinction; the coloration of the wing coverts is a more certain guide, for this includes longitudinal markings in the male, but barred markings in the female. In the young birds the beak is dark brown, but this fades into pale olive brown with age. The legs are at first pale yellow; they then deepen into brown and fade into slaty grey.

Until full plumage is entirely assumed, by about the beginning of November, birds of the year may be recognised by the fact that the base of the third long wing feather (the last to be moulted) is still supple and soft, whilst in old birds the entire quill is stiff and hard. The male Frenchman has horny knobs in place of spurs, and the larger these excrescences are the older and, when full-grown, the tougher he will be. Young birds of this species are only to be distinguished from their parents by the fact that they are less highly-coloured; the black and white of the gorget is less distinctly marked. In the first feathering the young birds are loosely feathered, and ragged in appearance, while the cinerous brown of the upper plumage is splashed with lighter markings.

The two species, when disturbed *en famille*, rise differently. A covey of English birds generally leave the ground almost simultaneously and settle again together, whilst the more crafty and running Frenchmen take wing much more independently, and frequently alight far apart from one another. And a fine chuckling the old cock bird frequently makes in calling his scattered family together when danger disappears!

MAURICE C. H. BIRD.

PHEASANT AND NEST.

THE STORY OF A WASP'S NEST

By JOHN J. WARD

Author of "Some Nature Biographies," "Peeps into Nature's Ways," etc.
With Photographs by FRANCES PITT

WHEN the cold nights and mornings commence, trouble falls upon the wasps' community. Over that thriving city with its thousands of inhabitants there literally comes a frost, a "killing frost" as Shakespeare puts it, and then we may paraphrase from Wolsey's famous speech and say of that populous city, "Farewell, a long farewell, to all thy greatness!"

ENTRANCE HOLE TO A NEST OF THE COMMON WASP.
The nest itself is shown on the opposite page.

From that hour things go wrong with the busy throng. No longer is there a continual traffic in and out through the gateway, the only entrance to the city. Only occasionally will a worker crawl feebly out, and even then, instead of the characteristic hurried flight, as on business bent, it probably comes to rest near the entrance at any spot where the warm rays of the sun penetrate. Even the sentinel at the gate will now permit a mischievous wood-louse to pass slowly by her and enter that stronghold which has been so long and bravely held against all comers.

Within the city things are even worse, for many of the workers have not returned, and this alone, in a community where every individual has his specific work to perform, is enough completely to disorganise matters. Here, for example, are hungry grubs, or larvæ, that need feeding; there, certain repairs are urgent, the neglect of which threatens danger to the frail structure of the home; but, worst of all, those remaining in the city make no attempt to meet the emergency. Under normal conditions, by an extraordinary effort on the part of every individual, the difficulty would have been met, but now it is different; the inhabitants are content to rest sluggishly amongst the cells—for they have lost heart.

This sharp and sudden frost is not alone

responsible for the catastrophe. The blow commenced to fall many days before, when one night some of the worker Wasps alarmed their relatives by crawling into their quarters much earlier than usual, numbed and cold. When inside the nest they quickly revived, but it was a bad omen! Whether the fact of this misfortune to some of the workers was communicated to the Wasp queen I am quite unable to say, but certainly her behaviour became quite different after that shock.

Previously, she had always deposited eggs which ultimately produced workers, or neuters, which are really imperfect females; the queen herself is the only perfect female in her community. Consequently, the business of egg-depositing rests entirely with her; and it was in this direction that her behaviour changed. She commenced to lay eggs which hatched out grubs that eventually developed into perfect females like herself. Whether the eggs were actually different, is a matter that I cannot here debate; it may be that the after feeding of the young grub brought about the change.

NEST OF THE COMMON WASP *IN SITU*, WHEN THE SOIL HAS BEEN REMOVED.

Later on, it frequently occurred that some of the workers became numbed as night drew on, and in the early morning they got later and later in leaving the nest. At this time, too, the queen Wasp again changed her ways. From her eggs now appeared a brood of males. It was several days after this brood of males, or drones, had been hatched when that "killing frost" overtook the Wasp city, and brought such dire distress to its inhabitants.

The blow had fallen, and for the moment the once busy city had come to a standstill. Later in the day, when the warm sun made its declining heat felt, the Wasps within the nest began, one after another, to arouse themselves; and it quickly became evident that something unusual was taking place.

The last broods of males and perfect females, or young queens, were making their way out of the nest. Until now, the latter had lived amicably with their mother and the workers within, and they appeared to do no work. At all events, they did not fly in and out of the nest to gather materials either for food or building purposes. Likewise with the fat-bodied drones. They were even less productive members of the community, for their only function was that of becoming fathers to the generation of the future, and by early winter every one of them will have perished from cold. On the young queens, however, depends the future of the race.

Now both the drones and the young queens were leaving their home. The remaining workers gave no heed to them. Instead they were busy with the white grubs they had fed and tended with so

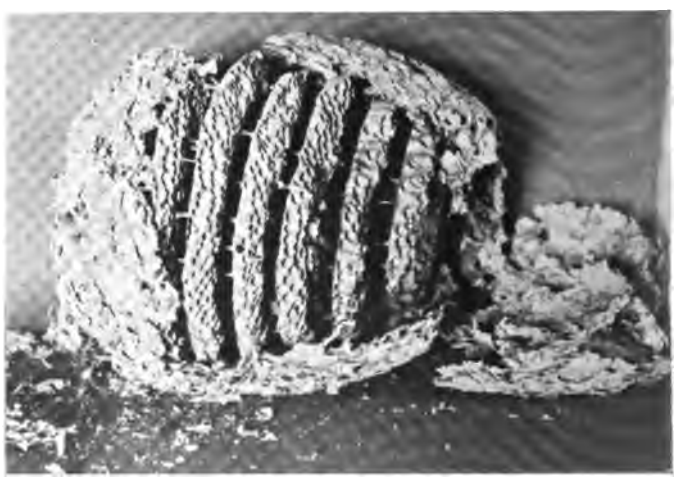
SIDE VIEW OF NEST.

much jealous care; but no longer were they feeding them. They were now ruthlessly dragging them from their cradles, one by one, and carrying them outside the nest, where they left them to perish. Apparently they recognised the futility of attempting to rear them, and, rather than let their charges slowly die of starvation, they subjected them to exposure, so that their end should come quickly. After this work is performed, those workers who have carried out this last function, take no further interest in the fallen city, but wander aimlessly about until wet and cold brings death to them.

So the vast city becomes a ruin, and its five thousand or more scattered inhabitants terminate their existence, all excepting, perhaps, three or four of the young queens; for most of them also eventually succumb to the Wasp's arch enemy, frost. The old queen, although she leaves the nest with the young queens, naturally stands less chance of surviving; especially is this so if the city that she founded has been a large one, and her resources have been largely drawn upon. Only occasionally when a nest is broken up in mid-season by a storm or other untoward agency, does the queen survive to give origin to another nest, for then her productive powers have not become exhausted.

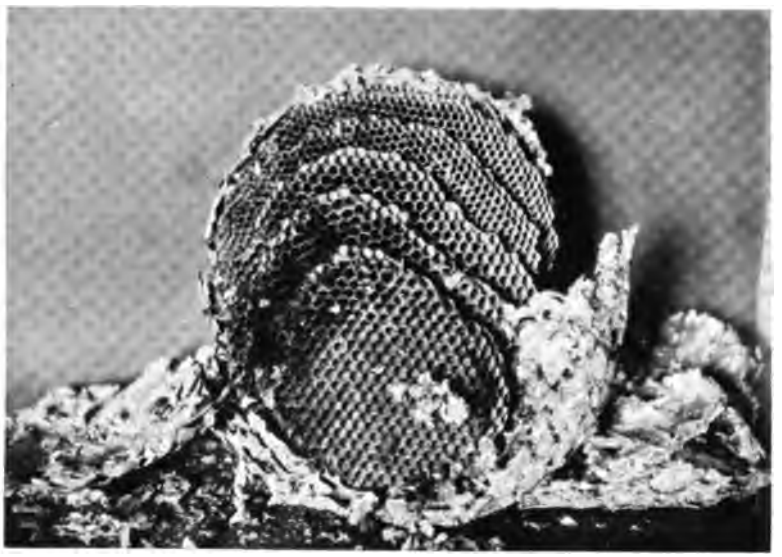
Our purpose now must be to see what becomes of the three or four surviving fertilised queens, for, as I have previously stated, out of that vast cityful only these remain to carry on their species to succeeding generations.

After the mating the male Wasps soon perish, and the queens of the future generations seek shelter in the crevices of walls, or amongst rubbish heaps; indeed, any dry situation, where they are well protected from the cold winds and frost, provides suitable quarters in which to hibernate. Should the young queen, however, once become exposed during the cold period, she rarely has the strength to find a new hiding place, but lies inactive until cold, or perhaps a hungry bird, abruptly terminates her career. And we should remember that, with her death, has also died the hopes of the colony



SIDE VIEW OF NEST WITH THE PAPER COVER REMOVED, SHOWING THE COMBS AND THEIR CELLS.

which she was to found. In short, we may say that with her die five, ten, or fifteen thousand Wasps (the number depends largely on the species to which she belongs); for had she lived, and her colony flourished, its population might have reached such numbers. This, too, is why fruit-growers frequently offer rewards in early spring for each queen Wasp—it is not the queen that they are anxious to buy, but her possible progeny.



END VIEW OF THE NEST SHOWING THE FRONTS OF THE COMBS.

Now it is a sunny morning in early May. All has gone well with the dormant queen; she has safely slept away the winter months, and now she is basking on the warm wall between whose rough stones she has hidden. Presently, she commences by means of her legs to clean up her wings, and smooth down the scattered hairs that clothe her body; then she briskly brushes her face. Finally, she draws each of her antennæ, or feelers, one at a time, between her folded legs, so cleaning them from base to tip. Her toilet is then complete, and for a moment she rests. Then suddenly she rises on her wings, and at that moment begins the work of building a Wasp city.

She passes slowly along, stopping every few minutes briefly to examine every ditch, bank, stone wall, and hollow tree. At last she arrives at a little, dark opening in the bank about an inch in diameter. This opening was, formerly, the main entrance to the place where a pair of field mice reared their family and kept a treasury of nuts and seeds of various kinds, but now it is deserted. It seems, however, to possess great attractions for this mother of the coming Wasp community. She carefully pushes out bits of the soil around the entrance; pulls here and there at a dry bit of grass; finally, she disappears inside. Just what she does inside I am unable to say because the bottom of the hole is a foot deep, but I have no doubt, by the long time that she is occupied there, that she is so well pleased with her discovery of so excellent a site for operations that she forthwith proceeds to tidy up the place a bit—at all events those parts where immediate action is to take place.

Almost any day afterwards, by waiting at that hole for a longer or shorter period, one could see the Wasp going in and out. It is evident that she spends a considerable amount of time outside her retreat as well as inside. One day her visits are particularly frequent; evidently she is not going far; indeed, by watching her closely one could, on each of her journeys,

see her suddenly drop down at almost the same spot against a fence some fifty or sixty feet away. A little observation at that spot explains the purport of her regular visits.

One of the palings of the fence has become very dry, and has split in all directions. Each time the Wasp appears she alights upon this paling, and from the split edges of it, by means of her strong jaws, she tears off fibres of the wood. These fibres she then gnaws and works about until, together with the saliva which she secretes, they become a pulpy mass, which she then carries in her mandibles to her burrow.

NEST OF THE WOOD WASP ON A SYCAMORE TREE.

The first few pellets so obtained are applied to a root or some projecting part in the roof of the chamber, until a stout little papier-maché pillar nearly half an inch in length is formed. To the end of this little footstalk is attached a little grey cover or cap of about half an inch in diameter, and to the underside of this are attached generally four, but sometimes three, cells. Then, in each of the cells is placed an egg. Such is the beginning of the nest, or the Wasp city. The queen, it will be observed, gathers her own building material, masticates it, and manufactures the paper for the walls of the city; then she turns architect and builder. Finally, her motherly instinct asserts itself, and she prepares the cradles for her young and deposits her eggs. Indeed, although she is designated a queen, yet in truth she is literally a maid-of-all-work.

Other cells are quickly added at the sides of those already formed, and fresh layers of paper are laid on above, each layer being extended to cover the newly-made cells, and turned in at the bottom, so that the comb of the cells is always covered above and protected below, for each cell is attached at its base and opens mouth downwards. In the Wasp citydom everything is topsy-turvy, and, as I have already mentioned, the queen Wasp, at the very commencement of her city, lays its foundations at the roof of her burrow.

As the cells are formed, an egg is laid

WOOD WASP'S NEST ON A FIR BRANCH.
Part of the covering has been removed; only one small hole is used as entrance to the nest.

in each one. Before many cells are made, the eggs that were first deposited begin to hatch out their grubs, and then the queen has new work to attend to, for the helpless grubs within their cells have to be fed. Nevertheless, they get attended to, and, as they grow, the walls of their cells are built higher to accommodate them; and the whole of the time this overworked mother goes on gathering material and building the cells and walls of the city, not to mention the depositing of eggs in each cell as it is formed.

Later on, some of the first hatched grubs cease to feed, and spin a silken cover over the mouth of their cells. That is a glad day for the queen Wasp, for not only is she relieved of the work of feeding the grubs, but soon she will have willing assistants around her, all ready and anxious to help on the great work which she has, by her own unaided labours, commenced and carried through to such a successful issue.

After a brief period the pupating grubs bite their way through the cover of their cells. They have now developed wings; indeed they are fully-developed worker Wasps. At their advent, things grow apace. Like their mother they naturally and immediately develop building proclivities, and leave the nest to gather in wood and vegetable fibres; they return with this material masticated ready to build cells or extend the boundary walls, as the case may be. What is more remarkable, they have the same motherly instinct as the queen herself, feeding and tending the young of the continually increasing nursery; in fact, they are like their mother in every respect, excepting that under ordinary circumstances they never lay eggs.

With the increased labourers new combs or terraces of cells are formed one below the other. Little pillars are attached here and there to the connecting point of some of the cells, and to these are added three or four cells, just as in the first instance; then more cells are placed beside these by numerous workers until each

A WOOD WASP'S NEST WITH THE PAPER COVER REMOVED TO SHOW THE CELLS.

little group meets, and the complete comb is formed. In this manner are the various terraces produced, and as the cells are all arranged mouth downwards, their bases serve as stages for the workers to move about upon while they feed the developing grubs in the tiers above. With this increased production of cells, the queen can no longer assist in the work of building, or of tending the young, for her whole time is devoted to depositing eggs in the cells prepared by the workers.

The broken nest shown on pp. 368 and 369 makes the whole matter clear as to the arrangement of the cells and their suspended terraces or combs, while the illustration of the exterior of the nest on p. 368 reveals its papery covering more in detail, and shows its shelly patches, each of which is composed of numerous tiny bands of paper prepared by the many workers that built the city.

On pp. 370 and 371 are shown examples of tree building Wasps' nests, which differ from the species that build underground only in respect to the site selected for their dwelling and in minor details that need not be considered here. Indeed the story of all species of British social Wasps is much the same. Each thriving city commences with the labours of the hibernated queen; each thriving city terminates with the wreck and ruin of its wonderful fabric after the sexual generations have appeared just before winter.

JOHN J. WARD.

RUINS OF A WASP'S NEST THAT WAS SCRAPED OUT AND EATEN BY A BADGER.
Wasps' nests are esteemed a luxury by badgers.

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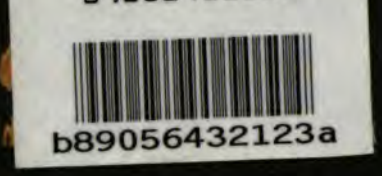
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